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**No. I.**

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# **NOTES ON PANAMA.**

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**Compiled and arranged by  
Capt. H. C. HALE, General Staff.**

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**November, 1903.**

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**WASHINGTON:  
GOVERNMENT PRINTING OFFICE.  
1903.**

**WAR DEPARTMENT,  
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## NOTES ON PANAMA.

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### I. HISTORICAL SKETCH.

“Alonso de Ojeda landed on the Isthmus of Panama in 1499. Later on the Spaniards found many warlike Indian tribes there. Eight principal tribes are enumerated. Those in Darien were specially troublesome.

“Columbus visited the port of Chagres and the bay of Limones in 1502. Having heard of the mineral riches of Veraguas he made the first attempts at colonization on the banks of the Belen. The renowned mineral wealth of the Isthmus attracted many navigators, and it was given the name of Castillo del Oro (golden castle).

“The warlike and intrepid natives fought heroically to preserve their liberty, and there are to-day over 10,000 natives who still preserve their original wild independence.

“In 1510 Diego de Nicuesa brought a large expedition to Panama and was appointed governor. He founded the city of Nombre de Dios, which was sacked and burned in 1595 by English freebooters. In 1546 Christopher Peña came with 130 men to settle the territory, but accomplished nothing. In 1513 Balboa, who was in command at the Isthmus, organized an expedition of 190 Spaniards and 1,000 Indians, which ended in the discovery of the Pacific.

“Owing to complaints made against Balboa, an expedition of 2,000 men was sent from Spain in 1514 under Pedro Arias Dávila (called Pedrarias), who succeeded Balboa. Pedrarias sent people to settle the Pacific coast and founded the city of Acla. He had Balboa beheaded in the latter place in 1517.

“In 1521 Pedrarias transferred the seat of government from Santa Maria la Antigua del Darien to the village of Panama.

It may be said that the conquest ended with the transfer of the government to Panama, for Darien was abandoned with the conviction that it was impossible to conquer it, and the remainder of the territory presented no obstacles. The ports of Chagres and Panama, with the Cruces road, were thus opened to traffic between the two oceans.

"Owing to the famed riches of the Isthmus and its exceptional geographical position it was a target for the attacks of pirates for about one hundred years, which greatly disturbed its commerce and industry.

"The following towns were sacked or burned at different periods: Portobelo, Santa Maria la Antigua del Darien, Nombre de Dios. The castle of San Lorenzo was destroyed. Finally Panama, the wealthy and populous capital, was sacked, burned, and destroyed by the pirate, Henry Morgan.

"In 1699 William Paterson, a Scotchman, sailed with 1,500 men to establish a colony in Darien. He bought land of the Indians and settled at Acla, calling it New St. Andrew and the adjacent country New Caledonia. The colonists immediately began to improve the port of Acla, or Puerto Escoces, as it is called to-day. They opened a canal and erected a fort, in which they mounted 50 guns; they also erected a house on a mountain overlooking the port, from which they commanded a long view and could guard against surprise. This colony, being refused recognition or assistance from the Spanish Government, was soon without resources, and the majority died of hunger. A few reinforcements subsequently arrived, but they were attacked by a Spanish force of 1,600 men, three months later, and finally defeated. Of the remnant of the colony but 30 souls eventually returned to Scotland alive.

"Under Bolivar the Republic of Colombia gained its independence of Spain in 1819, and was officially constituted December 27, 1819.

"At the time when the South Americans rose in arms against Spain and proclaimed their independence Panama was divided for administrative purposes into two provinces, Panama and Veraguas, each ruled by a governor.

"While New Granada, Venezuela, and Quito were struggling for their independence, Panama, owing to its lack of resources and its strategic position, had to patiently await the result without participating.

"The English expedition under General McGregor, which arrived at Portobelo in 1819, might have hastened the emancipation of the Isthmus had not McGregor remained at Portobelo and allowed himself to be surprised by the Spaniards. The result was fatal to the Isthmus, as it led the Spaniards to double their vigilance and increase their garrison.

"However, its hour was approaching. In 1821 part of the garrison (700 to 800 men) was taken by the governor and captain-general of Granada to Quito, leaving four companies of troops in Panama, under Lieut. Col. José Fabriga, at the time governor of the province of Veraguas.

"The Panamanians believed the hour of independence to have arrived. The first cry was raised in the village of Los Santos; then the capital followed. The movement was immensely popular and no bulwark could stay it. On November 28, 1821, the ayuntamiento, boldly risking the consequences of such a step, convoked all the military, civil, and ecclesiastical bodies in a general assembly, in which it proclaimed the independence of the Isthmus from the Government of Spain and adhered to New Granada.

"In 1826 the Latin-American Congress was held in the city of Panama. It was participated in by Colombia, Central America, Peru, and Mexico, and a treaty of coalition, providing for the furnishing of a certain annual military contingent by each country, was concluded, but never ratified by all the Governments.

"In 1830 José Domingo Espinar, commander in chief at Panama, usurped authority and assumed the title of civil and military chief, declaring the government of the Isthmus independent of that of the Republic of Colombia. This condition lasted three months, when the usurper himself decreed that the original régime be restored. He continued, however, as a dictator, but became so tyrannical that he was finally superseded by Col. Juan Eligio Alzuro at the instigation of the commanders of the garrison. Espinar was exiled to Guayaquil. Alzuro retained military command of the garrison, and quiet was restored for a while. He, however, soon began to act arbitrarily, and on July 8, 1831, he called an assembly and proposed the independence of the Isthmus from the central government. The motion was unanimously defeated. But the Venezuelans, expelled from Ecuador, 'who

expected to make the Isthmus their inheritance,' incited Alzuro against those who opposed him, and he called another assembly, from which, by intimidation, he wrested a declaration that the Isthmus should be a state independent from the Government of Colombia. The assembly appointed him supreme military commander, and Gen. José de Fábrega civil chief.

"Colonel Herrera then began to collect forces against Alzuro, who then also assumed the civil authority, deposing General Fábrega and exiling him and other prominent citizens, with admonitions never to return. They did, however, return, and began inciting the population in Darien to insurrection against the tyrant. Finally, on August 24, a desperate struggle took place between Alzuro on one side and Herrera and Fábrega on the other. Alzuro was defeated and taken prisoner, and he and his counselors were shot. The executive power approved the conduct of Herrera and expressed words of praise to him for his services in the campaign."—*Directory of Panama, 1898.*

The vast Republic split up into Venezuela, Ecuador, and the Republic of New Granada February 29, 1832.

The same year a conspiracy headed by two officers again attempted to overthrow the constituted government. They failed and were executed. Comparative quiet followed until 1840, when a revolution, with Herrera at the head, was instituted, independence was proclaimed and for two years maintained. In 1842, however, Panama again submitted and returned as a province of New Granada.

An important treaty was concluded between the United States and New Granada December 12, 1846, guaranteeing, among other items, equal commercial privileges on the Isthmus of Panama to citizens of both contracting countries. In order to secure constant enjoyment of the advantages accruing to the United States in this treaty and as compensation for these advantages, and in order to secure unembarrassed transit across the Isthmus, the United States guaranteed to New Granada neutrality of the strip and the rights of sovereignty and property then possessed over the Isthmus by that country.

Grievances preferred by foreigners have in numerous instances strained the relations between the National Government and the powers, and the neglect of the Government to

afford safe passage across the Isthmus finally became so flagrant that in 1854 a protest signed by the consuls of several powers, including the United States, Great Britain, and France, was addressed to the governor of Panama. It was not till after 1859, when the President of the United States asked Congress for power to protect Americans on the Isthmus, that the more serious causes for complaint disappeared.

Except for some minor disturbances in the provinces of Agüero and Veragua in 1854, comparative peace prevailed in the Isthmus from the revolution of 1840 to 1856.

In 1855 Panama, under a liberal constitution, became a State of New Granada. The executive authority was vested in a governor. The outlook for the future appeared hopeful, but from this time forward the Isthmus became afflicted with constant conflict; revolution became a habit.—Authority consulted, *Bancroft, Native Races*, vol. 8.

“The constitution of April 1, 1858, changed the Republic into a confederation of eight States, under the name of Confederation Granadina.

“On May 8, 1863, an improved constitution was formed, and the States reverted to the old name of Colombia—United States of Colombia.”—*Commercial Relations*, 1900.

“After the great civil war of 1861, generally known as the Mosquera revolution, the sixth constitution of government was framed and adopted. It changed the name of the country from New Grenada to the ‘United States of Colombia,’ disestablished the church, confiscated nearly all church property, and disfranchised the clergy, but extended the suffrage to all other male persons 18 years of age and upward.

“This constitution remained in force for about twenty-two years, and during that time there were as many as eleven ‘revolutions,’ or one on an average of about every two years.

“After the hopeless failure of the armed revolt against the Nuñez administration, in 1885, another constitution was framed and adopted, making the seventh in chronological order within a period of not quite fifty years. This last constitution changed the name and title of the country from the United States of Colombia to that of ‘The Republic of Colombia,’ thereby intending to convey the idea that a consolidated republic had been substituted for a confederation of ‘sovereign states.’”—*Scruggs, The Colombian and Venezuelan Republics*, 1899.

"The insurrection which began in October, 1899, was ended on November 22, 1902, the fleet and war stores of the insurgents being restored to the Government."—*Commercial Relations with the United States, 1909.*

Discontent born partly of the failure of the central government to pass the Hay-Herran canal treaty resulted in November, 1903, in the separation of Panama and the establishment therein of an independent republic.—(*Compiler.*)

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## II. GEOGRAPHY, PHYSICAL AND DESCRIPTIVE.

### (a) AREAS AND BOUNDARIES.

“Panama is bounded on the north by the Caribbean Sea, west by the Republic of Costa Rica, south by the Pacific Ocean, east by the Department of the Cauca.

“The area of Panama is 32,380 square miles, of which only about one-half is inhabited. Its greatest length, from the Darien Range to that of La Cruz, on the side of Costa Rica, is about 420 miles. The widest part of the Isthmus lies between the mouth of the Escribanos River, on the Atlantic side, and the point of Mariato, on the Pacific, a distance of about 118 miles. The narrowest part lies between the Gulf of San Blas, on the Atlantic, and the mouth of the river Chepe, on the Pacific, a distance on a straight line of 31 miles.”—*Colombia, Bureau of American Republics*.

### (b) GENERAL PHYSICAL GEOGRAPHY.

“MOUNTAIN RANGES.—Panama belongs geographically to Central America, and is the last of the long line of isthmian formations which form so many links in the chain by which the northern and southern continents have been connected since Tertiary times. At the Costa Rican frontier it trends round from southeast to east, and maintains this normal direction through a series of rythmical curves for over 400 miles to the Atrato Valley, which, jointly with that of the San Juan, forms the true parting line between Central and South America.”—*Stanford's Compendium of Geography, Central and South America, Vol. II*.

“A massive range known as the Cordillera de Baudo traverses the Isthmus through nearly its whole length, dwindling away in the neighborhood of Panama. This range approaches now the southern coast and again the northern, and though not a very elevated one (1,557 feet, average height, with peaks of from 2,296 to 2,624 feet, and passes less

than 900 feet high) it gradually increases in both height and breadth as it approaches Veraguas; in Chiriqui it reaches its greatest elevation and runs through the middle of the Department into Costa Rica."—*Colombia, Bureau of American Republics*.

"Through the Cordillera de Chiriqui the Costa Rican orographic system passes into Panama, which it traverses in its entire length to the Gulf of Darien under various sectional names, such as the 'Cordilleras of Veragua' and 'San Blas.' These cordilleras do not form a continuous mountain range, but rather a number of loosely connected ridges, spurs, and offshoots, which decrease generally in altitude in the direction of the east, and are here and there crossed by historical passes which fall below 300 feet, and are the lowest that occur anywhere between the Atlantic and the Pacific.

"It seems obvious that here also the two oceans formerly communicated through several channels, and that Panama, like other parts of Central America, constituted an insular chain, which has since been merged in continuous land partly by volcanic, partly by meteoric agencies. This may be even inferred from the geological constitution of the uplands, which consists in the west of comparatively recent eruptive rocks and elsewhere largely of granites, gneiss, dolerites, trachytes, and crystalline schists.

"In the extreme west, where the Panama highlands attain their greatest elevation, the Central American igneous system is continued by three apparently extinct volcanoes—Pico Blanco, Rovalo, and Chiriqui.' West of Veragua the system becomes fragmentary and, so to say, dislocated, culminating in Mount Capira, on Panama Bay, then falling to 700 feet in the Ahoga-Yeguas hills, which are crossed by a pass only 380 feet high, followed by the still lower Culebra Pass (290 feet), where the Isthmus itself contracts to a little over 34 miles in a direct line from sea to sea. In the San Blas section, with a mean altitude of less than 2,000 feet, the highest peak scarcely exceeds 3,000 feet, and here the Isthmus narrows to about 18 miles between San Blas Bay on the Atlantic and the head of the tide waters in the Rio Bayano on the Pacific coast. (*Stanford's Compendium of Geography, Central and South America*.) Near the western extremity of the Isthmus are found peaks of some considerable height, such as Cerro Santiago, 6,234 feet; Volcan de Chiriqui, 6,480

feet; Cerro Picacho, 7,054 feet; Cerro Horqueta, 6,234 feet, and Pico Róbaldo, 7,012 feet.”—*Report of the Intercontinental Railway Commission, Volume II, part 1, 1891-1898.*

**RIVERS AND LAKES.**—“The mountainous regions in the central part of the Department of Panama give rise to innumerable brooks and rivers which have their source in the cordilleras and irrigate the soil in every direction.

“The principal streams that irrigate the province of Coclé are: Rio Grande, Uvero, Hondo, Chorrera, Estancia, Anton, Hato, Farrallon, Chico, Majaqual, Calaboza, Mataabogodes, Piedras, Tejas, Lajas, el Coclé, etc.

“Province of Colon: El Chagres, Indios, San Miguel, Cocle, Candelaria, Calabebora, Guasaro, San Diego, Bananos, Changuinola, Sigsola, Tervis, etc.

“Province of Chiriqui: El Doraces or Culebras, el Golfito, Coto, Pavon, Claro, San Bartolome, Chiriqui viejo, Tabasara, Colorado, Chico, Gualaca, Chorchá, Fonseca, Covalés, David, Plantanal, Salado, Santiago, etc.

“Province of Los Santos: Rio Cambuta, el Guere, Guarare de la Villa, Pocrí, Escota, Parita, Pedasi, Caldera, Aria, etc.

“The province of Panama is irrigated by innumerable rivers, because it embraces the extensive territory of Darien, from whose ridges and mountains rise innumerable rivers, some of which, like the Tuira, the Balsas, the Sambú, and the Tayecua or Marea, are quite large and important.

“Central district: El Bayano or Chepo, the Chagres, the Culebra, Lagastes, Boca Fuerte, Pacora, Hondo, Manzanillo, Gatun, Grande, Chico, Mandinga, Nombre de Dios, Aguacata, and Capira.

“Territory of Darien: El Tuira, the most important of the rivers of the Isthmus. It has the greatest volume of water and is navigable by steamships to Yavisa. This river has many affluents, the principal ones being the Chucunaque and its affluent, Yavisa. This Chucunaque River has a long course and receives a multitude of tributaries from the Cordillera Septentrional, the Piedras, Rio Grande, Cupe, Cuna, Nique, Cubunella, Paya, Puero, etc.

“After the Tuira come: The Sambú, the Balsas, the Tayecua and Masea, the Chiman (all these have a great many tributaries), the Lara, Trinidad, the Sabana, Santa Barbara (which receives the waters of the Congo), the Cupunate, Pimeguilla, San Antonio, etc.

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"Lastly, the province of Veraguas is irrigated by the following rivers: San Pedro, San Pablo, Viro, Bubi, Punta-gorda, Rosario, Rio del Muerte, Corota, San Lorenza, Cañas, Suai, Cate, Santa Lucia, Rio Arena, Rio Quebro, Torco, Negro, etc."—*Directory of Panama, 1898.*

"Several of the isthmic streams descending from the central uplands have a somewhat lengthy course, their lower valleys being disposed parallel with the coast. But their basins are too narrow to send down any great volume except during the floods, when they often rise suddenly 20, 30, or even 40 feet above their normal level and sweep with tremendous force and velocity down to the coast.

"Such is the régime of the Rio Chagres, which has its course in the center of the Isthmus, and has hitherto proved one of the most formidable obstacles that the constructors of the Panama ship canal have had to contend with. After its junction at Matachin with its chief tributary, the Obispo, descending from the Culebra uplands, it flows directly to the north coast near Colon (Aspinwall), where the entrance is obstructed by a bar with an average depth of about 10 feet. In ordinary years its level ranges from 14 to 40 feet with the seasons, but unusually heavy rains may at times cause an absolute rise of as much as 40 feet, with a discharge of from 65,000 to 70,000 cubic feet per second. The difficulty of controlling such a volume rushing at tremendous speed down a narrow valley seems insurmountable, and all attempts at regulating these sudden freshets have hitherto proved ineffectual. The railway bridges of the interoceanic line running from Aspinwall to Panama are occasionally submerged, while immense damage is caused to the works on the Atlantic section of the canal.

"On the Pacific side the Rio Bayano presents fewer obstacles, because the western slopes are drier. But the bar at the entrance to its broad estuary is only 2 or 3 feet deep at low water, while the bay itself shoals so gently that large vessels have to ride at anchor 4 or 5 miles off the coast. Hence costly harbor works will be required at the Pacific entrance whenever the ship canal reaches the Gulf of Panama."—*Stanford's Compendium of Geography, Central and South America.*

"Various rivers flow into either the Atlantic or the Pacific, some through long and narrow valleys, others by shorter courses. The principal river is the Tuira or Darien. It rises

in the heights of Aspaves and receives the waters of a number of tributaries, among which may be named the Nique, Balsas, Paya, Puero, Cano, Lomon, Chucunaque (which itself has several tributaries navigable for small vessels), and the Tayecua or Marca. As thus increased the Tuira flows into the Gulf of San Miguel on the Pacific coast.

"The River Coclé is some 70 miles long, being navigable for small vessels for about 40 miles. It rises in the Andes, and receives the waters of 14 tributary rivers and a multitude of brooks. The Rio de los Indios and the Calabebora rise in the desert range which traverses the Isthmus and empty into the Atlantic. The first is navigable for 18 miles and the second for 21. The Doraces forms the boundary with Costa Rica. The Chiriqui and the Guazaro flow into the Atlantic.

"Another important river is the Bayano, or Chepo, which rises in the Andes and flows west and then southwest into the Gulf of Panama. It is about 160 miles in length and is navigable for about 125 miles. It collects on its course the waters of a number of tributary streams. The River Chagres is 102 miles long and navigable for about 60 miles. It receives the waters of more than 21 tributaries, and flows first southwest and then northwest, finally emptying into the Caribbean. Part of its channel has been utilized in the construction of the interoceanic canal.

"The Zambú River rises in the heights of Aspave and flows nearly parallel with the southern coast until it empties into the Gulf of San Miguel. It is navigable some 93 miles. The Chico and the Santa Matia flow into the Parita Gulf, the San Pedro and San Pablo flow into the Ensenada de Montijo, the Tabasara, Santiago Fonseca, and Chiriqui-viejo empty into the gulf of Alanje, and the Golfito flows into the Golfo Dulce, on the boundary of Costa Rica."—*Colombia—Bureau of American Republics, 1892.*

"The principal lagoons and marshes are: The lagoon of Chiriqui (improperly called lagoon, as it really is a gulf or bay, well protected by the archipelago in front of it), the lagoon of Tacu, and the lowlands of Catibal and Pruaya."—*Directory of Panama, 1898.*

**CLIMATE.**—"The climate varies very much, it being in certain regions warm but healthful, in others damp and sickly, and in others cold and salubrious.

"The whole coast, from the boundary of Costa Rica to the Gulf of Uraba, has a hot and damp climate, in which it is dif-

ficult for the white race to flourish by reason of swamps and marshes, whose exhalations are extremely unwholesome. To this is added the intensity of the heat, aggravated by the great humidity produced by the frequent rains and by the aqueous vapors rising from the sea, which the prevailing winds carry to the wooded plains that fringe the entire territory. There is a part of the Pacific coast to which this does not apply, for from Panama to Cape Burica there are no marshes or wooded plains, but, on the contrary, cereal-bearing fields and rivers which water and fertilize that generally inhabited region. The climate is as a rule warm, but not so damp, which permits the inhabitants to enjoy good health. The cordilleras are all cool and salubrious, but their slopes are uninhabited, both on the southern side, which bears the cereal grasses, and on the northern, which is covered with woods.

"The coast from Panama to El Choco is unhealthy. The interior of the Isthmus of Darien is very sickly, and only the negroes and Indian half-breeds can stand its excessively rainy climate, hot and damp, and its atmosphere, which the marshes make malarious. Though about the Darien cordillera the temperature is milder, it can not be said that the region is salubrious, and it will never be until the great woods and groves shall have disappeared.

"In Porto Bello the climate is unhealthy and the heat excessive by reason of the stagnation of the air and because the port is surrounded by high mountains, and noxious exhalations emanate from vegetable matters, both terrestrial and aquatic. The nights there are often stifling and the days marked by rains, with thunder and lightning, such as can not but terrify the unaccustomed visitor.

"It may be said that it rains in the department of Panama at least nine months in the year, and that, too, in extraordinary quantities. There occur, too, brief but very hard 'scuds' or showers and much thunder and lightning—a sure proof of the abundance of electricity in these regions.

"The dry months are February, March, and a part of April, and the hottest months are August, September, and October, in which the heat becomes almost unbearable. In the other months the breezes and the continual rain render the heat less intense, though, on the other hand, they make the climate disagreeable.

"In the territory which formerly constituted the provinces

of Chiriqui and Veraguas the heat is intense, though tempered by the rains from April to December. In the part of the Isthmus bordering upon the Cauca it rains all the year round at such a rate as to make the rainfall 90 cubic inches, while in Europe it is only 28 or 29."—*Handbook of Colombia, Bureau of American Republics.*

"When the sun is north of the Isthmus southerly winds prevail, and when south, northerly winds. As is the case with monthly means, the changes of temperature from hour to hour and from day to day are subject to much less variation on the Isthmus than in regions more remote from the equator. Alhajuela fairly represents the climate of the interior. Here the temperature at sunrise in the dry season is about  $72^{\circ}$ ; it soon rises rapidly, attaining about  $87^{\circ}$  at 1 p. m.; after this it falls rapidly to about  $81^{\circ}$  at sunset, and then subsides gradually to the minimum at sunrise. During the rainy season the temperature at sunrise is about  $74^{\circ}$ ; it rapidly reaches a maximum at noon, about  $85^{\circ}$ , and then falls to about  $80^{\circ}$  at sunset, and later to the minimum at sunrise. Thus, during the dry season, the daily temperature has a larger range and a later maximum than when rain prevails.

"At La Boca, situated on the bay of Panama, the minimum temperature occurs later, or at about an hour after sunrise, being then about  $75^{\circ}$  in both the dry and the rainy seasons. The maximum in the dry season,  $86^{\circ}$ , is reached at about 4 p. m., and in the rainy season,  $84^{\circ}$ , at about half past 2 p. m. The rate of fall is more gradual than at Alhajuela, the mercury receding at sunset in the dry season only to about  $86^{\circ}$  and in the rainy season only to about  $83^{\circ}$ . In short, the changes on the Pacific coast are less extreme and are later than in the interior, but the daily average is about the same.

"An annual rainfall of about 140 inches may be expected on the Atlantic coast, about 93 inches in the interior, and about 60 inches near the shores of the Pacific. There is a well-defined dry season, beginning in December and including the months of January, February, March, and part of April, a period during which the sun is returning northward from his southern journey to the Tropic of Capricorn, and the locus of heavy rainfall has been transferred southward from the Isthmus. This comparative exemption from rain is characteristic of the interior and of the Pacific coast, but somewhat less so of the region bordering the Caribbean Sea.

"Natives of the temperate regions can not safely perform arduous manual labor under exposure to a tropical sun, and dependence for such work must be placed upon the negroes of the West Indies. White men can supervise, but must not attempt more.

"Considering the average figures for the past four years, with a personnel of 2,275 on the canal, the percentage of disease has been 29.65 and the mortality 2.35 per cent. These figures do not exceed those on large works in any country.

"It should, however, be added that this personnel has been long on the Isthmus and is well acclimated.

"Among infectious diseases on the Isthmus yellow fever is undoubtedly the most to be feared by unacclimated persons of the white race. During the two recent epidemics of yellow fever, the first from May to December, 1899, and the second from March to September 10, 1900, only two cases appeared among the personnel of the company. The disappearance of yellow fever from the Isthmus from the year 1892 to the year 1897 would lead to the belief that the disease is in no wise necessarily endemic. The city of Colon, which up to about the years 1891 and 1892 was a terrain than which nothing could be better for yellow fever, reputed more dangerous than the city of Panama, has since that time remained free from any infectious disease and has escaped the yellow-fever epidemics of 1897, 1899, and 1900. This is due to the sanitary works which have been executed, the filling up of the many little swamps, and the cleaning of streets which before were veritable sewers. By these improvements the city of Colon has been considerably freed from the swarms of mosquitoes which rendered life insupportable.

"Might not a like result be secured for the city of Panama (1) by a good supply of pure water; (2) by drains to conduct sewerage to the sea, to which its situation and conformation are easily adapted, and (3) by watering the streets daily in the dry season and by cleaning them daily throughout the entire year. Now they are in a repulsive condition of filth. These three improvements, which I consider fundamental and essential, are now wholly neglected.

"There should also be instituted an effective quarantine service for vessels arriving in the harbor, for beyond all doubt the epidemics of 1897, 1899, and 1900, and the few cases which occurred in January, 1901, were due to importa-

tions, in one instance from the Atlantic and in three instances from the Pacific.”—*The Engineering Magazine*, July, 1903.

“In the late summer and autumn months, when the northerners are replaced by the southeastern trade winds, the Atlantic coast lands are occasionally visited by terrific cyclones, such as that of October, 1865, which wrought destruction among the shipping at Colon and was felt as far north as Cape Gracias a Dios. Thanks to these monsoons, the annual rainfall often exceeds 120 inches on the Atlantic side, or about double the discharge on the Pacific coast. But malarious affections are everywhere prevalent and yellow fever a frequent visitor, so that the Isthmus still remains the Sepultura de Vivos, the ‘living grave’ of Europeans, as it was named by the first Spanish settlers.”—*Stanford's Compendium of Geography, Central and South America*, Vol. II.

“In 1896 the average mortality was slightly over 64 per 1,000. Although this is considerably below the rate for 1888, when the canal encampments held an army of laborers equaling the present entire population of the city of Panama, and when, owing to their gregarious condition and the prevailing dissipation, epidemic diseases ran riot among them, carrying off scores at a time; nevertheless it is sufficiently high to brand the district with a distinctive and invidious character for insalubrity.

“Of the deaths that have occurred, 29 per cent are due to lung complaints, 18 per cent to febrile attacks, 10 per cent to dysentery, and the balance to a variety of causes.

“If further proof of the great mortality that prevails at Panama were wanting, the fact that with a dwindling population upward of 18,000 corpses have been received into the new Roman Catholic cemetery here since its inauguration in 1884 is of itself conclusive.

“Leprosy is another of the baneful scourges that have made the Isthmus their home. It is impossible to ascertain, even approximately, the number of lepers that infest the department, but, judging from experience, were the exact number made known the result would be, to say the least of it, startling. There is a lazar home for these unfortunates just without the city of Panama, at Punta Mala, where a few of the more hideous cases are segregated from the rest of mankind, but it is a primitive affair, and its unfortunate occupants receive neither medicine nor medical attendance. This

disease has become so great an evil throughout the Republic that the Government seriously contemplates converting Coiba Island, in the Pacific, into a leper refuge.”—*Colombia, British Diplomatic and Consular Reports. Report for the year 1896 on the trade of Panama.*

“Colon can at no time be considered a healthy locality nor in any respect a very desirable place of residence. In the beginning of the so-called ‘invierno,’ or wet season, tropical fevers are most frequent and fatal. What is called the ‘verano’ (summer), or dry season, is better. It is less unhealthy, and with proper care a stranger may sojourn there for a few weeks or months without constant dread of the cemetery. The streets, though very much improved of late, are often impassable in wet weather and never attractive when dry. The town is environed by stagnant ponds and lagoons, and the inland breeze is always laden with deadly malaria. Sickening odors assail the nostrils at every turn. The only species of animate nature which seems to really enjoy life here is the mosquito. Day and night he is your constant companion.

“However, the Isthmus can not be judged by Colon, as it is quite different on the Pacific shore. The distance by rail is 47 miles, and the cost of transportation about \$4 in American gold coin. The time required is about three hours. During the first hour’s ride from Colon to Panama there is very little to be seen. The country is a mere succession of swamps and lagoons, where it would seem impossible for human beings to live. Yet even before the country was partially reclaimed from a wilderness state by the railway there were occasionally seen rude huts inhabited by Indians, negroes, and mestizos. A little farther on cone-shaped hills with intervening lagoons and rapidly running streams are seen. Before the De Lesseps Canal Company cleared away the forest and jungle and thus changed the whole aspect of the country these hills and little mountain slopes were covered with dense forests, which were resonant with the screams of red monkeys and the shrill notes of tropical birds. All along the railway, even in this unfavored region, one now sees little towns and settlements, but few or no good houses. The habitations are for the most part thatched-roof sheds with dirt floors, and their inmates can hardly be classed as belonging exclusively to either of the three primal races.

“Ascending the dividing ridge between the Atlantic and

Pacific shores a marked change for the better is perceived. The whole aspect of the country is different. The temperature, though but a few degree lower, is less oppressive. The air is purer, the environments are more cheerful and inviting, and we no longer experience that strange mental depression which we felt on the Colon side. As we begin the gradual descent of the water-parting ridge toward the Pacific coast the beauty of the landscape often charms us, and we are tempted to forget all the discomforts and annoyances of Colon."—*The Colombian and Venezuelan Republics, Scruggs, 1900.*

"The late George S. Morrison, the civil engineer, in his address in December last before the American Geographical Society, said that the death rate on the Isthmus could be greatly diminished. He attributed the unhealthful climate to the fact that no systematic sanitary work has ever been undertaken.

"He said that before the United States could begin work on the completion of the canal thorough sanitary improvements should be made. With sanitary control and discipline exercised by the United States the greatest difficulties that have hitherto beset the Isthmus of Panama would be removed.

"The conditions of the Isthmus would be no worse than that of other damp tropical countries. The hills along the line of the canal would furnish sites for gardens and residences. He thought it was not impossible that in time this region, which has been regarded as one of the world's pest holes, might become a favorite winter resort."—*New York Sun, November 15, 1903.*

"FAUNA.—The great forests of Panama contain many wild animals, among which we may name the tiger (black or spotted), the jaguar of Darien (as voracious as that of Venezuela), the cougar, the javali or wild boar, the chunzo, erizo (hedgehog), lion (red, yellow, or black), oso hormiguero (ant bear), tigrillo (small tiger), zorro (fox), conejo (rabbit), tapir, venado (deer), puerco espin (porcupine), gato (cat), mono (monkey), and armadillo.

"On the Atlantic coast there are the tortoises, whose shell is so largely used, and white and green turtles. On the Pacific, besides the pearl oysters, there are found many kinds of oysters and mussels, and crustaceans, such as lobsters, crabs, shrimps, etc. In the sea the animals to be feared are

the tintorera (cuttlefish), the guaza, the manta, and the shark. In both oceans there abound the ceruzati, a fish weighing 55 pounds, and the mero, which weighs over 110. There are found also the bagre, the peztieria, the quichavo, the paro, and the casus, of some size, and the hurel, barbado, sábalo, hurello, corvina, cominata, and ruejo, of very fine flavor.

"There are in Panama two kinds of alligators and many kinds of iguanas. Among serpents we find the boa, the berrugosa, the equis, the bejuco, the cazadora, the boba, the viper (of many kinds and very poisonous), coral, and many sorts of lizards."—*Colombia, Bureau of American Republics*.

"The air also is alive with birds of gorgeous plumage—tanagers, toucans, humming birds, and euphonias (*Euphonia musica*)—the songs of many being varied by the discordant chatter of the monkeys, springing wildly from branch to branch, and by the screaming of noisy parrots. Among the few indigenous forms is the chrysothrix, a species of monkey which is confined to the Chiriqui district and will not live elsewhere. Most of the other mammals and other animals—tapirs, peccaries, pumas, jaguars, alligators, ant eaters, climbing porcupines, iguanas, deer, vampires—are common to all the surrounding lands."—*Stanford's Compendium of Geography: Venezuela and Colombia*.

"FLORA.—To the high temperature and precipitation corresponds a tropical vegetation of amazing exuberance and variety, especially in the southern districts, where the Central and South American forms are intermingled. Even the rocky headlands are clothed with verdure to their summits, while the running waters disappear beneath a dense tangle of overhanging branches, trailing or climbing parasites, stems, snags, and matted foliage. Soon after leaving the Atlantic terminus travelers by the interoceanic railway find themselves surrounded by scenes of tropical splendor such as can scarcely be surpassed even in the Brazilian woodlands. Cacao shrubs, palms, bananas, and breadfruit trees stretch their branches and foliage out on both sides, while the saturated soil is covered by a luxuriant growth of water plants of the most varied colors."—*Stanford's Compendium of Geography: Central and South America*.

"There are plants having medicinal and dyeing properties, textile and oleaginous plants. The Province of Veraguas

produces caracollillo, whose rare violet-purple tint is so much esteemed. Splendid palms of many kinds, cacti of capricious forms, and varieties of orchids abound. On the terraces and in the gardens of Panama flourish the aristocratic kananga of Japan, the starry jasmine, the heliotrope, the rose of Alexandria, and many other choice and delicate flowers."—*Directory of Panama, 1898.*

(c) **COAST LINE.**

**GULFS, BAYS, ETC.**—The Department of Panama has on the Atlantic side some 478 maritime miles of coast, 240 between the mouth of the Tarena River and Colon and 238 between Colon and Costa Rica. On the side of the Pacific the coast of Panama is 767 maritime miles in length.

"On the Atlantic coast the principal ports or bays are those of Colon or Aspinwall, Almirante, Chiriqui, San Blas, Caledonia, and Porto Bello. Besides these there are some 25 smaller ports.

"On the Pacific coast the principal ports or bays are those of Panama, San Miguel, Montijo, and Golfito. There are in addition some 30 smaller ports, among which may be mentioned that of Boca Chica, which serves as the port for the town of David."—*Colombia, Bureau of American Republics.*

**DESCRIPTION OF THE ATLANTIC COAST.**

"**CURRENT.**—On arriving within about 30 miles of the southern shore of the great bight known as the Gulf of Columbus, the pent-up water is forced to the eastward. This great eddy will generally be found running between Salt Creek and Porto Bello at the rate of 2 to 3 knots an hour. It is also to be observed that the northeasterly current runs strong close to the entrance of Porto Bello, and in the rainy season from  $1\frac{1}{2}$  to even 3 knots an hour as far as Farallon Sucio. Between the entrance of Chiriqui Lagoon and Chagres there is often, however, a narrow stream setting to the westward, which extends about 3 miles from the shore.

"**TIRBI (TERRABA) POINT** forms with Sarabeta Point the west entrance of Boca del Drago into Almirante Bay. On the west side of Tirbi Point the shore forms a dangerous bight, called Tirbi Bight. Between the points, three-fourths mile apart, is the front of a small neck of low wooded land, which is skirted by a reef on which the sea breaks heavily.

"CAURO AND LIME POINTS form the east side of entrance, the bar between them being shallow, and there is a patch of  $1\frac{1}{2}$  fathoms about midway between the points. A spit with less than 3 fathoms extends one-half mile across the entrance from Lime Point in the direction of Sarabeta Point, with 6 to 10 fathoms close-to.

"BOCA DEL DRAGO, the western entrance into Almirante Bay, is only one-fourth mile wide in the narrowest part and one-third mile at the entrance, and although affording a depth of 9 fathoms is so tortuous and exceedingly sharp in its turnings that it is too difficult for strangers to navigate without the aid of a pilot, who will come off from the settlement on seeing the usual signal. The Boca has in the channel a least known depth of 5 fathoms.

"SHOAL.—A shoal spot with 5 fathoms of water on it has been reported off the entrance to Boca del Drago, where a depth of 8 fathoms is indicated on Hydrographic Office chart No. 1384. The 5-fathom spot is on the following bearings:

"Sarabeta Point, S.  $31^{\circ} 30'$  W. (S.  $26^{\circ}$  W. mag.), distant 2,100 yards.

"Lime Point, S.  $1^{\circ}$  W. (S.  $5^{\circ}$  E. mag.).

"Approximate position: Latitude  $9^{\circ} 26' 36''$  N., longitude  $82^{\circ} 20' 30''$  W.

"SETTLEMENT.—The settlement extends on either side of Lime Point. Water is scarce, but a small supply of vegetables may be obtained. There is excellent firewood on the western shore.

"DIRECTIONS.—The Boca del Drago can only be entered under sail, with the sea and land breezes. Swan Cay, 180 feet high, and Sail Rock, 40 feet high, about 2 miles north-eastward of the entrance, are good marks; the latter is steep-to on its west side, and may be passed at a prudent distance.

"When a mile from the entrance the opening should be brought to bear S.  $3^{\circ}$  W. (S.  $3^{\circ}$  E. mag.), when a remarkably large tree on the extremity of Lime Point will be seen. Lime Point tree and Tristan Point in line lead nearly in mid-channel. Tristan Point is formed by tall table-topped trees, but has the appearance of a low bluff headland.

"Proceeding in with the range given, it will be necessary to bear up as short round as possible when Norte Point is seen just open of Cauro Point, N.  $73^{\circ}$  E. (N.  $67^{\circ}$  E. mag.), keeping it so astern until within about 300 or 400 yards of the western

shore, which is steep to the edge of the reef, and then haul up quickly S. 15° W. (S. 9° W. mag.), through the inner part of the narrows. When Cauro Point bears N. 43° E. (N. 37° E. mag.), or Swan Cay is open northward of it, the bank off Lime Point will have been passed, and a S. 35° E. (S. 41° E. mag.) course will lead into the lagoon, in not less than 5 fathoms, where anchorage may be taken up as most convenient under Columbus Island. The clump of trees on the mainland resembling a tower, formerly used as a leading mark, is not to be distinguished.

“TIDES AND CURRENT.—The tides at the Boca del Drago are similar to those at the Boca del Toro, but the easterly current sets against the ledge off the north end of Columbus Island with such force that it is turned to the southward, and, overpowering the ebb, runs into the lagoon at the rate of a knot an hour.

“CAUTION.—A vessel meeting with a calm or light airs between the Sail Rock and the entrance, or becoming unmanageable, should anchor at once and await a commanding breeze. The turnings in the narrows being so sharp, the utmost attention must be paid to the sails to maneuver quickly; and, if time permit, it will be safer to place a boat at the junction of the leading marks. H. M. S. *Cordelia*, 1865, found depths of 4 fathoms in the inner part of the channel where 6 fathoms formerly existed.

“ALMIRANTE BAY is about 13 miles in extent from east to west, but its interior is crowded by small islands, and its shores are so irregular that from north to south the breadth varies from 2 to 13 miles, and near the middle the bay almost forms two basins. In consequence of this it may be said to possess harbors within harbors, in which vessels of the largest class may enter without much difficulty, and in many places lie alongside the shore in security.

“The south side of Almirante Bay is bounded by a remarkable ridge of table hills, lying at the base of the great Cordillera, extending in a southeast and northwest direction about 15 miles. In some places it rises precipitously from the shore to the height of 600 or 700 feet, and only 2 miles inland reaches an elevation of 1,748 feet, which increases to 2,000 feet at its northwestern extremity. Several small streams descend from these heights into the southwest and west sides of the basin, but they are only navigable for a short

distance by small canoes. The east and west sides are very low and swampy and densely wooded. The north side is bounded by Columbus and Provision islands.

"COLUMBUS ISLAND is 7 miles long northwest and southeast and about 3 miles broad. It is flat and densely wooded, the tops of the trees being from 200 to 400 feet above the sea. The east side of the island is bounded by a white sandy beach, which forms two slight bays, and from Long Bay Point, which separates them, a dangerous reef extends to the northeast  $1\frac{1}{4}$  miles, breaking heavily in fresh breezes. The outer end of this reef lies N.  $28^{\circ}$  W. (N.  $34^{\circ}$  W. mag.),  $3\frac{1}{4}$  miles from Cape Toro, and the edge of soundings is only three-fourths of a mile distant.

"The northern extremity of the island is low and rocky, and from it a ledge of rocks extends northwestward  $1\frac{1}{2}$  miles, but being dry in places and having on it some remarkable islets which serve as marks, it is not so dangerous. Sail Rock, the outermost of the above islets, lies at the extremity of the ledge and is 40 feet above the sea. It is a barren black rock, steep-to on its west and north sides.

"Swan Cay, S.  $51^{\circ}$  E. (S.  $57^{\circ}$  E. mag.), one-half mile from Sail Rock, is a narrow rock about 70 yards long rising perpendicularly to an elevation of 180 feet and crowned with brushwood and a few cocoanut trees. There is no safe passage between these cays and North Point.

"The western extremity of Columbus Island is low and sandy and about a mile distant from the adjacent point on the mainland. Upon it is a small settlement. The south shore is low and swampy and bounded by mangroves, which are closely skirted by a coral ledge, steep-to.

"SETTLEMENT.—The principal settlement, Boca del Toro, now covers considerable territory, and the little fort is no longer distinguishable, the ground having been reclaimed and built upon for about half a cable to seaward. It is the seat of government on this part of the coast, and is on the southeast end of Columbus Island, on a narrow peninsula, faced on the north by a shallow bay open to the northeast. The population in 1894, including Old Bank settlement, amounted to about 5,000 inhabitants—Indians, negroes, and Spanish-Americans.

"The trade is principally in the hands of Americans.

"The boat landings are on the southeast side of the town.

There is a wharf at the settlement, alongside of which fruit steamers load. About five steamers call weekly during the fruit season (March to August). A buoy, which is not to be depended upon, marks the 2-fathom patch, 4 cables S. 16° W. (S. 10° W. mag.) from Fort Point. The patch of 2 fathoms charted northeastward of it has but 1½ fathoms.

"The United States is represented by an acting consular agent.

"SUPPLIES.—Fresh beef is scarce and of poor quality. Pork and poultry can be had in moderate quantities, but at high prices.

"Preserved provisions, salt meats, and bread are imported by trading firms, but a large stock is not kept on hand.

"Good fish are plentiful in the bay, and game is said to be abundant on the mainland.

"WATER.—Rain water is all that is to be had; it is contained in an iron tank (an old boiler) of a capacity of about 6,000 gallons.

"COAL.—There is no imported coal in the place, but coal of fair quality can be mined in the immediate neighborhood, and at very moderate cost, by using native labor.

"PROVISION ISLAND is 8 miles long east and west, with a ridge of irregular hills on its north side from 300 to 400 feet high. On the south side of this ridge the land is low, swampy, and skirted by numerous mangrove cays, with boat channels between, which extend all the way to the Crawl Cay Channel. The northeast side is foul, and the sea breaks on it with great violence to the distance of three-fourths of a mile from the northeast point. Cape Toro, the northwestern extremity of the island, is a bold scarped headland, easily recognized. There is a small black rock, steep-to, about 300 yards to the northeastward of it. A reef, steep-to, and on which the sea generally breaks, extends west nearly one-half mile from the cape.

"The west end of the island terminates at a low, sandy point, upon which there is a small settlement, and the land about it is so fertile in the growth of tropical fruits and vegetables that it gives the name to the island.

"BOCA DEL TORO, between Columbus and Provision islands, is the principal channel leading into the bay, and between Careening Cay, close off Columbus Island and Provision Island, it is about three-fourths of a mile wide. Both

sides, however, are skirted by a coral ledge, so that in the middle, in the narrowest part, it is only about one-fourth of a mile across. In the middle of the channel and across the Garcia bank or Middle ground, which lies just within the bay, a depth of not less than 5 fathoms may be carried; and if buoyed, 6 fathoms could be maintained.

"The edges of the reefs on the Provision Island side generally show themselves, but the water is so muddy at the entrance that the shoals there are not visible, and as Long Bay Point is dangerous, strangers will require a pilot.

"SHOAL.—The existence of a small coral patch is reported in Boca del Toro with 3 fathoms of water over it at low water. The 3-fathom spot is on the following bearings:

"Careening Point, N.  $3^{\circ}$  E. (N.  $3^{\circ}$  W. mag.), distant 800 yards.

"Mangrove Point, S.  $81^{\circ}$  W. (S.  $75^{\circ}$  W. mag.).

"There are depths of 4 and  $4\frac{1}{2}$  fathoms close around this patch.

"DIRECTIONS.—In a case of necessity, or with but little local knowledge, the following directions for the Boca del Toro will be useful and, to vessels drawing under 17 feet, quite safe.

"There is not much difficulty in recognizing the entrance, Cape Toro being a remarkable bold headland, but it must be approached from a northeast direction at a wide offing and with the sea breeze. An easterly set of the current should be allowed for. When the channel comes fairly open, bearing S.  $21^{\circ}$  W. (S.  $15^{\circ}$  W. mag.), a very remarkable large tree on Cristoval Island, called 'Pillar tree,' will be seen.

"The range for approaching and entering is Pillar tree in range with the eastern side of Split Hill and not the center of the hill. A small notch will be seen just to the eastward of the highest part of Split Hill and on the eastern slope; this in range with the Pillar tree will carry nearly in the center of the channel. Should the range be shut in by rain or mist after getting on it, it is better to head for the eastern tangent of Careening Cay until Toro Point bears abeam and then to head the course by compass about S.  $20^{\circ}$  W. (S.  $14^{\circ}$  W. mag.) through the channel, turning when Mangrove Point bears S.  $82^{\circ}$  W. (S.  $76^{\circ}$  mag.). A S.  $48^{\circ}$  W. (S.  $42^{\circ}$  W. mag.) course will lead across the deepest part of the middle ground, in 4 to 5 fathoms, when anchorage may be taken as most conven-

ient, in 12 or 13 fathoms, mud, provided Careening Point does not bear eastward of N.  $17^{\circ}$  E. (N.  $11^{\circ}$  E. mag.).

"The south end of Careening Cay is sufficiently steep for a vessel to heave down alongside, and between it and the Fort Point there is a 12-foot channel, admitting coasting vessels to a more sheltered anchorage off the settlement.

"In leaving the lagoon by the Boco del Toro it will be necessary to wait for the land wind. To attempt working out against the heavy swell which usually rolls in would be attended with considerable risk, notwithstanding the assistance of the outset, and if caught at the entrance by the sea breeze it will be more prudent for a vessel of heavy draft to run back. It is also necessary to be cautious not to haul out to the northeast before Cape Toro bears S.  $74^{\circ}$  E. (S.  $80^{\circ}$  E. mag.) to avoid the reef from that point.

"CAUTION.—Vessels drawing 18 feet should sound and buoy the channel, as Garcia Bank has changed, but there is a channel with a least depth of 4 fathoms.

"PILOTS.—Local pilots come off to ships, but are not reliable.

"TIDES AND CURRENT.—It is high water, full and change, in the Boca del Toro at 12h. 15m., and the rise is from 1 to  $1\frac{1}{2}$  feet. There is no flood stream, but a continual outset, depending upon the rains; in the dry season its strength is about a knot. The great easterly eddy sets on to the cays off the north side of Columbus Island at the rate of from 1 to 2 knots, and it will be met with off the Boca del Toro and should be allowed for after the cays bear southward of west.

"SHEPHERD HARBOR.—Of the many small basins formed by the islands off the south shore the largest and most favorably situated lies at the southwest end of Almirante Bay and is named Shepherd Harbor. It is about 4 miles in length in a northwest and southwest direction and from 1 to  $1\frac{1}{2}$  miles in breadth, with a depth of 12 fathoms on muddy bottom.

"On the northeast side it is bounded by Shepherd, or Iguana, Cay, which is  $1\frac{1}{2}$  miles long east and west, about one-half mile broad, and, in the highest part, 264 feet high. From the southeast end of the island a narrow coral ledge stretches off to the southward about a mile, upon which are several cays, the two largest named Garcia and Roldan. The channel between the south end of Roldan and the main is nearly one-half mile wide. From Snapper Point, which forms the south point of entrance, a ledge, nearly dry and steep-to, projects

to the northward 300 yards, but Roldan is bold to within 100 yards; elsewhere it is quite clear, with a depth of 15 fathoms.

"The western channel, between Shepherd Cay and Iguana Point, is about one-half mile wide. The cay is clear to within 100 yards, but from Iguana Point a coral ledge shows itself to the distance of 200 yards and is steep-to. All the dangers in the interior of the harbor are confined to the south shore and easily seen from aloft, and the coral ledges, which fringe most parts of the mangrove shores to a short distance, are so bold that a vessel may lie close to them. Secure anchorage may be taken up anywhere, as most convenient for watering, wooding, or refitting, and in many parts large vessels may lie alongside the shore. Shepherd Cay and the adjoining cays and a considerable portion of the mainland adjacent are now almost completely cleared and covered with banana and cocoa plantations. American steamers visit the several plantations in Almirante Bay and collect the produce. There is a landing wharf at the southeast corner of Roldan Cay. The chief supplies, however, are grown on the banks of the streams on the mainland, principally at Saurian and Cultivation creeks. Here the land is of extreme fertility and produces all the tropical fruits and vegetables, cotton, coffee, and sugar cane in the greatest perfection and with very little labor.

"The dense forest around the lagoon also yields abundance of most excellent ship timber, which is used on the island to build canoes and small coasting vessels. The most valuable timber is the eboe tree, which has a diameter of from 3 to 4 feet and grows straight from 50 to 60 feet, with large spreading arms, having crooks of all forms and dimensions. The zapatilla attains about the same height and is from 2 to 3 feet in diameter, but being rather brittle it requires caution in felling. The sum-wood, called also Spanish elm and caparo, is of the same dimensions, saws and works well, and is well adapted for planking, as it resists the trying effects of this climate better than the woods generally used for this purpose. This tree is also found on Popa Island. Cedar also grows to great size and perfection, and is used for the construction of large canoes, dories, and pitpans.

"WATER.—Four small streams flow into the south side of Shepherd Harbor, but they are only navigable for small canoes for a short distance. The largest is Saurian Creek, and it is the best at which to water; a vessel of large class may be conveniently moored within 400 yards of the mouth.

“DIRECTIONS.—Having entered Almirante Bay, if proceeding from the Boca del Toro, the north end of Cristoval Island must be approached cautiously to avoid a small coral ledge which lies northwestward three-fourths mile from Coco Point, the northern extremity of the island; the channel is about  $1\frac{1}{2}$  miles wide, with a depth of 15 fathoms. In running or working, Juan Point must not be brought westward of S.  $62^{\circ}$  W. (S.  $56^{\circ}$  W. mag.) until the ledge is passed.

“Juan Point is foul to the distance of about 400 yards, and from Tristan Point, on the western shore of the bay, a flat coral ledge, dry in places, extends  $1\frac{1}{2}$  miles to the eastward, having 3 and 4 fathoms on its outer edge, leaving a channel  $1\frac{1}{2}$  miles in breadth. The Cristoval side must, therefore, be kept aboard; it is everywhere bold within 400 yards, and should it be necessary to work through this part, a little white lookout hut on the highest part of Shepherd Cay must not be brought to the southward of S.  $17^{\circ}$  W. (S.  $11^{\circ}$  W. mag.) when standing to the westward.

“The southeast end of the Tristan Reef lies with Mangrove Point well open of Juan Point. To the southward of this there is no danger; either channel may be taken into the harbor, but the southeastern will be the most convenient with the sea breeze, and all that is necessary is to steer in mid-channel or work in by the Eye, avoiding the ledges off the entrance points.

“From the Boca del Drago, after passing Lime Point Bank, care must be taken to haul well to the eastward to avoid a coral bank extending from Donato Point on the western shore, the outer end of which bears S.  $3^{\circ}$  W. (S.  $3^{\circ}$  E. mag.) nearly  $2\frac{1}{2}$  miles from Lime Point. Tristan Point must also be very cautiously approached, and Juan Point not brought to the northward of East (N.  $84^{\circ}$  E. mag.), or a depth of not less than 10 fathoms be maintained before Shepherd hut bears to the westward of S.  $11^{\circ}$  W. (S.  $5^{\circ}$  W. mag.). With the hut bearing S.  $17^{\circ}$  W. (S.  $11^{\circ}$  W. mag.), the end of the Ledge will be crossed in 5 fathoms.

“CRAWL CAY CHANNEL.—At the head of the bight formed by the islands southwest of the Zapatilla cays, between Provision and Popa islands, is the Crawl Cay Channel, leading into the Almirante Lagoon. This cut has depths of not less than  $5\frac{1}{2}$  fathoms, between detached coral shoals, but it is so intricate and narrow, being in some parts not 100 yards wide,

that it is quite impossible to give safe directions for its navigation. The sea, however, is so tranquil and clear that every coral head is easily seen, and the tidal stream being weak, the pilotage may be effected by the eye from aloft, provided the weather be clear and favorable and the sun not ahead.

"The entrance is about 300 yards in width, but so hidden by mangrove cays within that it would be impossible for strangers to make it out, and the shore is far too dangerous to approach without being certain of the channel. There is a conspicuous saddle-shaped hill 670 feet high, about S. 62° W. (S. 56° W. mag.) of the anchorage off the Zapatillas, the south hummock of which, when brought to bear about S. 55° W. (S. 49° W. mag.), and in line with the northwestern extremity of Popa island, will lead to the opening.

"The north part of Popa, being formed of lofty trees growing straight out of the water, appears from this direction bold and distinct, and the end of the reef which runs to the northeast off Cobbler Point three-fourths of a mile and forms the east side of the entrance is steep-to and breaks heavily.

"The west extreme of the westernmost Zapatilla island, bearing N. 73° E. (N. 67° E. mag.) astern, leads up to the entrance.

"ZAPATILLA CAYS.—The west side of the outer part of the Tiger Channel is bounded by two narrow sandy islets named Zapatilla, which appear as one island, their general direction being west-northwest. They are each a little more than one-half mile long, and about 1,200 yards apart, a ledge almost dry joining them. Both are thickly wooded, affording excellent firewood, easily obtained; the tops of the trees are about 80 feet above the sea.

"The surrounding reef extends east-southeast 1 mile from the easternmost, the extreme bearing N. 70° W. (N. 76° W. mag.) 4½ miles from the Tiger breaker. Near the extremity the reef is one-half mile broad and generally shows itself, but it skirts the north and south sides of the cays at only a short distance. From the westernmost cay it stretches off a mile in a northwest direction, and at this extremity is 1 mile broad. Between it and the reef off Patino Point there is an intricate channel with many shallow heads.

"ANCHORAGE.—On the south side of Zapatilla Cays anchorage and the best shelter will be found in 10 fathoms, sand and mud, with the west end of the westernmost cay

bearing N.  $27^{\circ}$  E. (N.  $21^{\circ}$  E. mag.) about 1 mile distant. The soundings are very irregular and change suddenly in some parts from 6 to 12 fathoms, but everywhere the bottom is formed of mud and sand.

“CAUTION.—The edge of soundings lies about 6 miles northward of the Zapatilla Cays; but farther west the edge is close to the land. At night or in thick weather, if eastward of the Zapatilla Cays, a vessel might stand in until the first sounding is obtained, but this must be done cautiously.

“POPA ISLAND, which forms the northwest boundary of Chiriqui Lagoon, is of moderate elevation, but at the north end there is a very remarkable isolated hill named Mount Popa, with a rounded summit 1,300 feet above the sea, and is a serviceable object. The south side of the island is covered with trees, termed by the traders “sum-wood,” which grow to large dimensions and are conveyed to Cartagena for ship-building. Good coal has been found on this island. There is a channel into the lagoon between Water Cay and Popa Island, carrying 6 fathoms water, but it is too narrow and tortuous for a stranger to navigate. Between the west side of Popa Island and the main there are narrow deep channels leading into Almirante Bay navigable for trading craft and launches.

“CHIRIQUI LAGOON.—The Chiriqui Lagoon is 32 miles long from east to west, 12 miles wide in the center, 5 at its east and 10 at its western extremity, and is capable of receiving in security vessels of all drafts. The entrance between Bluefield Point and Water Cay is  $3\frac{1}{2}$  miles wide, and, being open north and south, is very easily recognized. Bluefield Point is a bold rounded headland.

“There is not less than 8 fathoms in the fairway over a channel, which is about one-half mile wide, and there is no bar. The southern part of the lagoon has depths of 15 to 20 fathoms, decreasing toward the shore.

“The principal trading places are the Chirica Mola and Frenchman Creek.

“The north side of the interior of Chiriqui Lagoon is thickly fringed with detached shoals and coral heads, steep-to; and the main entrance itself, although from one-half to 1 mile in breadth, is so intricate that with sailing vessels it should only be taken with the sea and land breezes. These shoals extend to a distance of  $4\frac{1}{2}$  miles to the southward of

Bluefield Point, and so block up the east end of the lagoon that that part is only navigable for small handy vessels. The navigation is not difficult, for the water is so clear that the eye can guide from aloft. The mangrove creeks at this end are so deep that they afford ready places for concealment.

"The eastern and southern shores of the lagoon for a very considerable distance inland, as far as Man Creek, 17 miles from the east end of the lagoon, are low and swampy, and there are only a very few spots in this space where a landing can be effected.

"At Man Creek the base of a great spur from the Cordillera reaches the shore and only 2 miles inland has an elevation of 2,672 feet. This lofty ridge extends about 5 miles to the westward, when the Chiriqui Valley, from 3 to 5 miles wide, separates it from another ridge 2,840 feet high, at the southwest end of the lagoon, about  $2\frac{1}{2}$  miles inland. At the foot of each of these ranges there is a trading post.

"The south side of the lagoon westward of the Chirica Mola is free of danger and may be safely navigated by the lead. The west side is low, swampy, and uninhabited; it is skirted by a coral ledge from one-fourth to three-fourths of a mile distant, with 6 and 7 fathoms close-to.

"The easternmost stream that flows into the southeast corner of the Chiriqui Lagoon is the Catabella Creek; it is very small and will only admit canoes to a short distance.

"Toro Creek, or San Diego River, empties about  $3\frac{1}{2}$  miles westward of the Catabella and communicates with the Chirica Mola just below its rapids. To the westward of the entrance there are a few fishermen's huts.

"WATER CAY is low, flat, and densely wooded, the tops of the trees at the east end reaching to the height of about 120 feet above the sea. The eastern end of this cay is formed of low red-clay cliffs, and very close off the eastern extremity there is a small dry rock, which, on a S.  $24^{\circ}$  E. (S.  $30^{\circ}$  E. mag.) bearing, seen just open of the point, is the leading mark into the lagoon. A reef, on which the sea breaks heavily, stretches off from it 300 yards and skirts the whole of the northeast side of the cay. At 600 yards from the east point the depth is 5 fathoms.

"CHIRICA MOLA RIVER is the only stream of any magnitude in the lagoon and enters it 4 miles to the westward of Toro Creek. It has formed a small delta, which projects out

to a well-defined sandy point at the entrance, S. 5° E. (S. 11° E. mag.) 9½ miles from Bluefield Point. On its eastern side, about 1½ miles from the entrance, the shore forms a small cove, named Irish Bay, which has 3 to 4 fathoms, under the mangroves. Small trading coasters generally collect their cargoes here from the small settlements around. They lie completely hidden by the high trees.

"A small low mangrove island divides the mouth of the Chirica Mola into two channels, the eastern of which is alone navigable, and on the bar during the dry season there is less than 2 feet of water. At this period the water is brackish about 2 miles above the entrance. The banks are low and inundated for a distance of about 3 miles, whence they rise, and at the first rapids are 7 feet above the river. To this point, a distance of about 12 miles, the stream varies in breadth from 100 feet to nearly 600 feet and in depth from 2 to 12 feet. As already observed, at the commencement of the rapids a branch of the river turns to the southeast, forming the Toro Creek. Above the rapids the bed of the river is so full of rocks that its ascent can only be accomplished in small strong canoes and with very great labor.

"SETTLEMENT.—About 10 miles above the landing at the rapids, on the right bank, is the most considerable village of the Valiente Indians, and a trading post for a long time has been established here. Cotton and hardware manufactures are brought from Jamaica and bartered for sarsaparilla, vanilla, cattle, and hides. The situation is said to be healthy, and communicates by footpaths with the Biarra and Cata-bella creeks.

"THE COAST westward of the Chirica Mola forms a bight 5½ miles wide and about 3 feet deep. The interior consists of small mangrove lagoons, in which the manatee is frequently captured. The west end of this bight terminates at the entrance of the Warri or Biarri River, the eastern entrance point of which forms a well-defined and easily recognized projection. The entrance of the Biarra is about 20 feet wide, and on the bar there is only a foot of water in the dry season. Canoes ascend to the first rapids, about 8 miles from the mouth, where there is a small settlement. From this river the mangrove shore of its delta again recedes inward and, curving to the northwestward, forms a large bay, about 8 miles wide and 3 deep. About 3 miles from the Biarra, at

the foot of the highlands already described, is the entrance of Man Creek, which, in the rainy season, is navigable for canoes two days' journey.

"From the head of the bay a shallow bank extends out nearly 2 miles, and in the southwest corner, by the side of a rivulet at the base of the hills, there is a trading post.

"Thence the coast is low and swampy, forming the delta of the Chiriqui, which river enters the lagoon at the northwest point of the bay. The shore in this space is closely skirted by a coral ledge, steep-to. The entrance of the Chiriqui River is so small that a stranger will have great difficulty in discovering it among the narrow openings in the mangroves. In the dry season the bar is impassable, except by hauling over it, and in the heavy rains the numerous rapids are too formidable even for canoes.

"From the Chiriqui the low swampy shore which bounds the Chiriqui Valley trends westerly 5 miles to Frenchman Creek. About midway is Cabbage Creek, of no importance.

"FRENCHMAN CREEK emerges at the base of the lofty ridge which forms the west side of the Chiriqui Valley, and, although unnavigable, taking its rise in the adjacent mountains, it is a constant running stream of good water. The land to the southwestward and westward of it is firm and wooded all the way to the southwest end of the lagoon, and, being free of morass, the locality has been well chosen for the establishment of a trading post. The settlement stands on the west side of the entrance of the creek and around it is a small cultivated space, which is most fertile in the production of all tropical fruits and vegetables. This end of the lagoon also abounds in turtle in the season.

"The position, indeed, has been found so favorably situated, and, comparatively, so healthy, that a bridle path has been opened along the west side of the Chiriqui Valley and across the mountains to Ciudad David, near the Pacific, by means of which cattle have been brought from thence to this spot and then conveyed in canoes to the Boca del Toro settlement in three days. The shore is here quite clear, and there is excellent anchorage in 7 fathoms about one-half mile distant. Numerous small streams descend from the table ridge into the west side of the lagoon, but the Robalo is the only one navigated by small canoes.

"ROBALO RIVER entrance lies near the southwest corner of the Chiriqui Lagoon, on the north side of a shallow mangrove bay, about 2 miles westward of Frenchman Creek. Although very narrow, it is navigated by the sarsaparilla pickers in their little canoes, two or three days' journey, according to the state of the river. At the end of one day's paddling rapids are met with, and after two days' ascent it receives a small stream from the southward, which throws so large a body of water into the main branch as to render it almost impassable after very heavy rains. The banks are said to be densely covered with trees of the largest dimensions.

"WATER.—The best place in the lagoon to water is at Frenchman Creek. There is also an excellent and convenient spring in the little sandy bay on the east side of Bluefield Point, off which there is anchorage; it is, however, difficult to get at, and so exposed as to be dangerous with strong westerly breezes and land winds.

"DIRECTIONS—TIGER CHANNEL.—Vessels bound into the Chiriqui Lagoon with the sea breeze should approach by the Tiger Channel, which, between Tiger Breaker and the east end of Zapatilla Reef, is 4 miles wide. After passing southward of the breaker the opening into the lagoon is readily distinguished, and a course should be shaped to pass from three-fourths to 1 mile from the east end of Water Cay. From this a southerly course must be taken, until the west extreme of the Zapatilla Cays is in line with the eastern extremity of Water Cay, bearing N.  $24^{\circ}$  W. (N.  $30^{\circ}$  W. mag.), taking care to bring these marks on before Valiente Peak is in line with the south end of Toro Cays.

"Or, when the extremities of Water and Zapatilla cays are in line as above, a very small rock, 3 or 4 feet above the sea, close off the north side of Water Cay Point, will be seen just open of it, and this mark will lead between the shoals. When Valiente Peak is over a hut at the east end of a small sandy cay, on the east side of Bluefield Point, bearing N.  $33^{\circ}$  E. (N.  $27^{\circ}$  E. mag.), a vessel will be inside them, and may shape her course as convenient. It is necessary, however, to observe that it will not be prudent for a large vessel to go to the eastward of the Chirica Mola, to the entrance of which the leading mark, or the same course, will carry her.

"The rock off Water Cay lies so close to the point that it must be used very cautiously as a mark, and only when the

Zapatilla Cay is not seen. As the tops of the trees on the west end of the latter cay are only 80 feet above the sea, it will perhaps be necessary and safer to guide the vessel from aloft, so as to keep that mark in sight as long as possible instead of trusting to the rock and bearing.

"Great attention is requisite, for the water at entrance of the lagoon is so discolored that the shoals can not be seen, and as they are steep-to, with deep and exceedingly irregular soundings, the lead is almost useless, and there is only a space of about 400 yards to spare from the shoals on the west side of the channel.

"There is another channel to the westward of the above, full three-fourths mile wide from east to west, but so difficult of access, for want of marks, that without the assistance of a pilot it is dangerous to navigate. However, with some local knowledge the following directions will assist to guide safely into the lagoon in a case of necessity:

"Pass three-fourths mile eastward of Water Cay, and when Water Cay Point bears W. (S.  $84^{\circ}$  W. mag.) steer S.  $23^{\circ}$  W. (S.  $17^{\circ}$  W. mag.) until it bears north (N.  $6^{\circ}$  W. mag.), thence a south (S.  $6^{\circ}$  E. mag.) course will lead through between the shoals at the distance of about 800 yards.

"If bound to the southwest part of the lagoon, when Valiente Peak is in line with the north side of Bluefield Point, a course as most convenient may be pursued; but if bound to the Chirica Mola, it will be necessary to stand on until Valiente Peak bears N.  $39^{\circ}$  E. (N.  $33^{\circ}$  E. mag.) or Popa Hill N.  $35^{\circ}$  W. (N.  $41^{\circ}$  W. mag.), when a S.  $51^{\circ}$  E. (S.  $57^{\circ}$  E. mag.) course will lead to the entrance of that river.

"In leaving the Chiriqui Lagoon it will be necessary to wait for the land wind, either in the evening—if it comes off early, which it very frequently does—or in the morning, soon after daylight. To run through the eastern channel the leading mark must be brought on from a position well to the southward, with Valiente Peak bearing to the northward of N.  $34^{\circ}$  E. (N.  $28^{\circ}$  E. mag.). Steer out, with the east end of Water Cay in line with the west end of the western Zapatilla Cay, N.  $24^{\circ}$  W. (N.  $30^{\circ}$  W. mag.), and when Valiente Peak comes in line with the east side of Bluefield headland, N.  $45^{\circ}$  E. (N.  $39^{\circ}$  E. mag.), you will be between the outer shoals, and a north (N.  $6^{\circ}$  W. mag.) course will lead clear out to sea.

"To run by the western channel, the east point of Water

Cay must be brought to bear north (N. 6° W. mag.) (the course through) before Mount Popa bears westward of N. 35° W. (N. 41° W. mag.). When Valiente Peak is seen over Little Toro Cay, N. 56° E. (N. 50° E. mag.), the shoals will be cleared, and a course to sea may then be shaped.

“Should it be necessary to work up from the west end of the lagoon, the north shore must be approached very cautiously, for no marks can be given to avoid the shoals off that side. As the south side can be navigated by the lead, it will be better not to stand more than about halfway across from that shore, until the leading marks for the channels are nearly on.

“TIDES.—It is high water, full and change, about noon, and the spring rise in the Chiriqui Lagoon is about 1 foot. In the interior of the lagoon there is seldom any tidal stream, but an outset to the northward, according to the state of the rivers. In the dry season, from March to June, off the Chirica Mola, and as far out as the entrance of the main channel, the strength of the ebb is from one-half to 1 knot an hour, and there is sometimes a weak flood stream; but outside and in the small channels to the westward there is a continual outset, running at the rate of 1 or 2 knots, and after long heavy rains even as much as 3 knots, in the main channel.

“BLUEFIELD POINT, 3 miles S. 30° W. (S. 24° W. mag.) from Cape Valiente, is a bold bluff wooded headland 180 feet high and easily recognized. About 200 yards to the westward of it there is a small black rock, 6 feet out of water, the western side of which, as well as the southwest extremity of the bluff, is steep-to.

“From abreast the black rock a sandy beach, backed by mangrove swamps, trends about northeast 600 yards, and from the north end a dry coral ledge extends about 200 yards to the Little Toro Rock.

“TORO CAYS, about one-half mile westward of Little Toro Rock, are small islets, lying so close together that they generally appear as one narrow island, about one-fourth mile in length, from north to south. They are formed of dark indurated clay, in which are embedded thin spiral layers of pebbles and stones, and their summits are covered with wood. From a northeast and southwest direction the southernmost of these cays are seen to rise perpendicularly from the sea, and have a similar appearance to those off Cape Valiente.

The ground is all foul inside of them, and a ledge extends from the northernmost north-northwestward 400 yards. There are 5 fathoms at 400 yards to the westward.

"BLUEFIELD ROCK, a small perpendicular black rock 32 feet high, with two or three remarkable trees on its summit, is easily recognized from the westward; it lies on the south edge of the Valiente bank, 800 yards to the northward of Creek Point, and marks the narrowest part of the channel into Bluefield Creek.

"BLUEFIELD CREEK, on the south side of Cape Valiente, is  $4\frac{1}{2}$  miles in extent, east and west, but the south side of the creek is so indented that its breadth varies considerably. The narrowest part of the entrance is 800 yards across, but within it is nearly  $1\frac{1}{4}$  miles wide in some places and has a depth sufficient to receive vessels of large draft in perfect security. There is no bar.

"The interior is exceedingly picturesque. The vessel will appear to lie in a deep valley, the gorgeous densely wooded hills rising on the north side to the Valiente Peak and on the south side to an elevation of 180 to 500 feet. The eastern end is swampy and bounded by low mangroves. From the northeast end a pathway leads across the narrow isthmus which connects the peninsula to the main, and at the southeast end a small narrow ridge of irregular hills rises to the height of 640 feet.

"On the south shore of the creek, in a small plain to the eastward of Carolina Point, there is a small stream of excellent water, and all around the Valiente Peninsula may be seen the detached huts of the Valiente Indians, with small cultivated spots here and there. The huts of this tribe will be elsewhere met with, scattered around the adjacent lagoons and at the entrances of the small rivers on the coast, but this is the only spot where they appear to have formed a regular settlement; sometimes, however, the peninsula will be found entirely deserted, for in their long fishing and hunting excursions they are accompanied by their whole families.

"SCRUBBY POINT, the southwest entrance point of Bluefield Creek, is low and woody. It is the northeast extremity of a narrow neck of land three-fourths mile in length, which terminates to the southwest at Bluefield Point, the east point of entrance to the Chiriqui Lagoon.

"SUPPLIES.—Water may be obtained from the stream on the

south shore, from which a shallow flat extends some distance, but by means of a long hose the water can be conveyed into the boats. Wood will be found all around, but, when time is not an object, it will be better to proceed to the Zapatilla Cays for this purpose, where there will be less risk to the health of the crew. The seine may be hauled with great success in any of the sandy bays, but it is necessary to be prepared to meet with small alligators and to be careful that the people are not electrified by the torpedo.

“The papaw, a most excellent vegetable, grows almost wild all around the inlet, and the banks of several of the streams on the main afford an abundant supply of bananas and plantains. There is also fair hunting, but it is attended with some risk. The dense rank underwood is infested with snakes of the most venomous description, and a season seldom passes without a fatal accident occurring among the sarsaparilla pickers.

“DIRECTIONS.—The extremity of the Torro Ledge is about west of Scrubby Point, and from it to the nearest point of Valiente Bank the channel into Bluefield Creek is a mile wide, with 11 to 18 fathoms water, except about midway, where there is a depth of 8 fathoms. Both the edge of the Valiente Bank and the opposite bold projecting points which separate the bays are steep-to, but the bays themselves are very shallow within the lines of the points.

“Vessels having occasion to visit Bluefield Creek had better enter by the Tiger Channel, taking care in so doing to give the Tiger Breaker a wide berth and not to haul in to the southward until the Toro Cay bears eastward of S. 11° E. (S. 17° E. mag.). By waiting until the sea breeze is established the channel may be navigated without the necessity of making a board. Steer toward Bluefield Point, taking care not to bring it to bear westward of south (S. 6° E. mag.) to avoid the edge of the Valiente Bank, until the hummock on the south end of the Bluefield Ridge at the head of the creek is in line with Carolina Point, S. 74° E. (S. 80° E. mag.).

“This mark will lead nearly in mid-channel to the narrowest part, when the anchorage may be steered for. It will be better, however, not to go farther in than to bring Cape Valiente in line with a remarkable bluff named Observatory Point, which lies a short distance to the southward of it, and anchor in 11 fathoms, mud, with a large hut on the summit

bearing N. 23° W. (N. 29° W. mag.), and Bluefield Rock about N. 69° W. (N. 75° W. mag.). A position to the eastward of this loses the advantage of the breeze, by no means desirable in so confined a valley and in such a fearful climate as this.

"A bank of 2 fathoms is chartered in mid-channel just within Carolina Point, with deep water on either side; and there are several shallow patches farther in, with deep water between them.

"TIDES.—It is high water, full and change, in Bluefield Creek at 12h. 30m., and the rise is about a foot. There is no perceptible stream on the flood, but the ebb will assist a vessel in working out.

"VALIENTE PEAK.—From Cape Valiente, the northwestern extremity of the Valiente Peninsula, to Chiriqui Point a rocky shore extends easterly 2½ miles, and bold, irregular, densely wooded hills rise abruptly from the shore to the height of 500 or 600 feet. On the western shore of the peninsula and about a mile southeastward of Cape Valiente one of these hills terminates in Valiente Peak, 722 feet high, which, being much higher than any other summit on this part of the coast, is a most remarkable object and excellent guide from a long distance.

"VALIENTE CAYS.—From Cape Valiente the western face of the promontory turns sharply in a southeast direction for 1½ miles and is fronted by a shallow coral bank extending 1½ miles. The north side of this bank is bounded by a range of small islets and rocks, forming the southern side of the Valiente Channel, which is here 1½ miles broad. Near the western edge of the bank there is also a small low rock, named Middle Rock, with sunken rocks between it and the cays.

"These islets and the Tiger Cays appear to be of precisely the same formation as those lying close off Escudo de Veragua. Those off Cape Valiente are equally remarkable, being perforated in the same way and crowned with coconut trees. They appear to be wasting from the action of the waves, and one has been washed away.

"CHIRIQUI ROCKS.—From Chiriqui Point a coral ledge called Chiriqui Rocks extends about west-northwest 1½ miles, and terminates at 400 yards beyond Barren Rock, 10 feet high, within which are several rugged, rocky islets from 50 to 150 feet above water.

"VALIENTE CHANNEL, between Barren Rock and the Tiger Cays, has depths of 6 to 9 fathoms on either side of Valiente Breaker.

"VALIENTE BREAKER, N.  $35^{\circ}$  E. (N.  $29^{\circ}$  E. mag.),  $1\frac{1}{2}$  miles from the extremity of Cape Valiente, is a very small head of 3 fathoms, steep-to, which breaks heavily when rollers prevail, even in the finest weather, and is extremely dangerous. Between it and Barren Rock there are depths of 10 and 11 fathoms, and between it and the Tiger Cays the channel is three-fourths mile wide, with 6 to 9 fathoms.

"TIGER CAYS, which bound the north side of the Valiente Channel, consist of three small red-clay islets about a mile in extent from east to west. The easternmost and largest lies  $1\frac{1}{2}$  miles from Cape Valiente, and is covered with brushwood, but on the others are trees with their tops about 35 feet above the sea. The cays are connected and surrounded at a short distance by a coral ledge, almost dry, preventing landing anywhere, although it is steep-to.

"TIGER ROCK.—At 1,200 yards N.  $64^{\circ}$  W. (N.  $70^{\circ}$  W. mag.) of the westernmost of the Tiger Cays lies Tiger Rock, a small detached rock 6 feet above the sea and steep-to, having 14 fathoms water between.

"TIGER BREAKER, 800 yards N.  $71^{\circ}$  W. (N.  $77^{\circ}$  W. mag.) of Tiger Rock, is a small isolated breaker, also steep-to and extremely dangerous, for it does not always show itself. From Tiger Breaker Valiente Peak and Cape are in line and Toro Cay bears S.  $3^{\circ}$  W. (S.  $3^{\circ}$  E. mag.).

"DIRECTIONS.—The widest channel is westward of Valiente Breaker and between it and Tiger Cays.

"Little Toro Rock, a sugar-loafed islet 100 feet high, in line with or open of Cape Valiente, bearing S.  $33^{\circ}$  W. (S.  $27^{\circ}$  W. mag), leads westward of the breaker in about 9 fathoms. When Barren Rock bears N.  $85^{\circ}$  E. (N.  $79^{\circ}$  E. mag.) keep it astern on that bearing until Bluefield Point bears S.  $5^{\circ}$  E. (S.  $11^{\circ}$  E. mag.), then steer for it. This mark will lead westward of Valiente Bank and up to the leading mark for Bluefield Creek. If proceeding into Chiriqui Lagoon, pass about 1 mile westward of Toro Cays and follow the directions given for Tiger Channel.

"The flood stream in Valiente Channel is charted as running one-half knot an hour to the southwest and the ebb from 1 to 2 knots in the opposite direction, the strength of the lat-

ter being caused by the easterly current and the outset from the lagoon. This increases the swell, which is generally so heavy that it is by no means a safe channel to work out of nor for a stranger to enter, for the break over the Valiente Rock may not occur for long intervals.

“**VALIENTE PENINSULA.**—From Chiriqui Point the shore trends about southeast 5 miles to Tobobo Bluff, which forms the southeastern extremity of the Valiente Peninsula, having on its northern side a small cove with bold irregular hills rising from it all along. The beach is of white sand, skirted by small islets and detached rocks and reefs to the distance of 200 to 400 yards, upon which the surf breaks furiously. It is remarkable that this is the first clear white sandy beach met with to the westward of Chagres. Elsewhere, as far to the westward as Greytown, the beaches are composed of dark, almost black, ferruginous sand, which is so impregnated with minute metallic particles that a magnet thrust into it will frequently be brought out completely coated with them. The only exception is the above beach and the sea or northern sides of the outlying cays and islands, which are bounded by beaches of pure white calcareous sand.

“It is also remarkable that the beach of the Mosquito shore northward of Greytown is in many parts similar, except that the sparkling appearance seen there is owing to small particles of mica, which at first sight have been mistaken for gold dust.

“**PLANTAIN CAY**, northeastward 1 mile from Tobobo Bluff, is a small but remarkable wooded islet, rising abruptly from the sea to the height of 230 feet, and between it and the bluff there is a similar cay, named ‘Tobobo,’ but only 150 feet high. Between these cays there is a narrow channel, adapted for coasting vessels. Plantain Cay has some small rocks, steep-to, close off its north side.

“**TOBOBO BANK**,  $5\frac{1}{2}$  miles eastward from Plantain Cay, is a small coral bank with 7 to 10 fathoms water, which tops with heavy rollers and is exceedingly alarming; and N.  $51^{\circ}$  E. (N.  $45^{\circ}$  E. mag.)  $5\frac{1}{2}$  miles of the cay there are 10 fathoms, on a narrow coral ledge, with 16 to 17 fathoms, which lies just within the edge of soundings and has 30 fathoms inside it. Vessels should approach this neighborhood with great caution.

“**TOBOBO BIGHT.**—From Tobobo Bluff, a bold prominent headland 500 feet high, the shore trends to the southeastward

and eastward to Old Bess Point and forms a deep irregular mangrove bight. The inner part of this bight is very shallow and skirted by a dangerous reef, which breaks heavily about a mile from the shore and is steep-to. There are several small openings, however, forming boat channels into Tobobo Creek, in the northwest corner.

"There are two huts on the south side of Tobobo Bluff and a spring of good water in a small sandy cove to the northward of them.

"From Old Bess Point the coast trends about southeast 3 miles to Coco Plum Point, which is about a mile to the north-northwest of the entrance of the Caña and is fringed with a reef to a considerable distance. About midway, close to the shore, there is a small cluster of islets named the Tooley Cays, and abreast them the wooded land rises to the height of 460 feet.

"ESCUDO DE VERAGUA is an island  $2\frac{1}{2}$  miles long from east to west and about three-fourths of a mile broad, and its southwestern extremity lies east-northeastward 10 miles from Coco Plum Point, the nearest part of the mainland. It is low and woody, and the trees grow so very regular in height that when first sighted it appears like a small island of tableland which, when approaching from the northward, will be seen to slope down gradually to the westward. The eastern part of the island is formed of soft, reddish-brown, perpendicular cliffs from 40 to 50 feet high, in which are embedded several species of marine shells.

"From the destructive action of the waves, however, the cliffs have been cut into and separated here and there at very short distances from the body of the island, forming small islets; some of them have been pierced through, and the arches, being crowned by dense foliage and trees from 70 to 80 feet high, have a most remarkable and picturesque appearance when seen from a short distance. The west end and south side of the island are very low and swampy and bounded by a dark sandy beach, similar to that found on the mainland. The southwestern extremity is steep-to and affords the only landing place, which, however, is at most times difficult of access on account of the heavy surf. From the west end a reef extends about 200 yards, and also skirts the north shore at a distance of one-fourth mile and the east end one-half mile outside the little clay islets; from the middle of the south side a ledge extends about one-half mile.

"During the rainy season several small rivulets force themselves through the sand on the south side of the island, but the supply of good water is so scanty that the few fishermen who visit it in the turtle season are obliged to dig wells

"ANCHORAGE.—A vessel may anchor off the southwest end of Escudo de Veragua, but will ride extremely uneasy, and not at all times safe; for although the soundings show a sandy and gravel bottom, it is but a thin stratum over a flat shelf of coral, which does not afford good holding ground. Should it be necessary to take shelter here, the west end should be rounded in a depth of not less than 8 fathoms, and a berth taken wherever the sea appears the most smooth, in about 10 or 12 fathoms, taking care, however, to leave plenty of room for dragging or weighing with the land breeze, which sometimes comes off suddenly with considerable force.

"TIDES.—There is a rise of tide of from 1 to 1½ feet at the island of Escudo de Veragua. In the daytime, at the anchorage, the current generally has a westerly set, which ceases at night.

"BANK OF SOUNDINGS.—The regular bank which skirts the main forms, to the eastward of Escudo de Veragua, a large tongue, extending from the island in an east and northeast direction about 8 miles and to the northward 5 miles, with a tolerably regular increase in the depth; but to the northwestward the soundings are irregular, as about 3 miles distant they change rapidly from 30 to 10 and 14 fathoms. They are also irregular to the southward, but there is no danger, and a vessel may work to the westward quickly, between the island and the main, by means of the eddy, which generally runs in that direction.

"CAÑA RIVER.—The Caña separates the territories of Chiriqui and Veragua. The entrance is S. 60° W. (S. 54° W. mag.), 11 miles from the northwest point of Escudo de Veragua, and readily distinguished by two huts, one on either side; that on the western point is more like a house, and, being generally whitewashed, is a conspicuous object. About 5 miles from the mouth, in a southerly direction and near the foot of the Tiger Spur, there is a small village inhabited by Indians who are employed in grazing cattle, collecting sarsaparilla, and washing for gold dust, which is occasionally brought down in small quantities. Small canoes can navigate the stream thus far, but the northeast swell rolls in so

heavily that the passage of the bar is only safe in very favorable weather.

**"THE COAST.**—From the Caña a low sandy shore extends about southeast for 19 miles to Buppan Bluff. About 3 miles westward of the bluff is the entrance of Pedro River, and about the same distance farther on is that of the Chiriqui. Both are very small, and can only be entered by canoes after heavy rains.

"Eastward of the bluff the shore forms a sandy bay  $2\frac{1}{2}$  miles long, through the middle of which a small stream clears an opening for its exit in heavy rains. From the bay to the entrance of the Passiowla a ridge of red cliffs extends to the eastward, skirted by a beach and crowned by a clump of remarkable flat-topped trees about 200 feet above the sea. From the Passiowla to Coaita Point the usual sandy beach is intersected by two low rocky shelves. About midway a coral ledge extends about one-fourth mile and is steep-to. In this space four small streams descend from the Catalina Hills, the easternmost of which is visited by sarsaparilla pickers in small canoes. The Passiowla is also navigable for small canoes for a short distance after the heavy rains, but at other times the mouth is blocked by a dry sand bar.

**"BUPPAN BLUFF.**—The west end of the above beach terminates at the base of a large bold promontory, formed by two bluff headlands close together, and a third, about  $1\frac{1}{2}$  miles westward of them, named Buppan Bluff. All three rise precipitously from the beach in round cones to an elevation of from 700 to 800 feet only one-fourth mile inland.

**"LANDING.**—From Buppan Bluff a small dry ledge extends about 400 yards, under the lee of which, in moderate weather, there is a landing place.

**"TIGER HEAD.**—At about 11 miles westward of Buppan Bluff a large spur extends in a northwest direction, which gradually descends with a long slope into the plain; a little below the summit, 3,882 feet above the sea, there is a small projection called the Tiger Head, but more like the ear of that animal, which is most remarkable when seen from the northwest and northeast quarters, and being generally visible when the higher summits behind are clouded, it is a useful landmark.

**"KING BUPPANS PEAK.**—The south side of the easternmost hill descends with a slight gradual slope about  $2\frac{1}{2}$  miles to the southeast, when it rises suddenly to the summit of a

narrow conical hill 2,846 feet high. It then forms, between the summit and a much higher ridge behind, a deep, hollow notch, which is a most remarkable feature, although backed by the loftiest part of the Cordillera, which reaches an elevation of 7,140 feet at about 15 miles from the coast.

"The name 'King Buppans Peak' has been given to this hill by the Mosquito Indians, who, it is said, penetrated thus far in one of their marauding excursions, accompanied by their king. From the island of Escudo de Veragua, distant 22 miles S. 15° W. (S. 9° W. mag.), it is a most conspicuous object among the neighboring heights.

"COAITA POINT, which lies under the northeast angle of the Catalina Hills, is low and sandy, and the most southern point on this side of the Isthmus of Panama.

"NO ANCHORAGE.—From this point to the Chagres, a distance of 83 miles, the shore runs nearly straight, without any sheltered anchorage whatever; and, indeed, without safe landing except in native boats under favorable circumstances, at spots known to the coasters and fishermen, for heavy surfs break continually along the whole shore. Abreast Coaita Point the edge of soundings is about 6 miles distant, and the depths will be found regularly decreasing to the shore, which is generally bold and clear.

"CATALINA HILLS.—The deep valley through which the rivers Candelaria and Calawawa run is about 4 miles wide, and is also well marked; its western side is formed by the Catalina Hills, a large mass of irregular rounded heights, rising abruptly from the shore to an elevation of 1,738 feet, and its eastern side by a ridge, with a gradual rise to a height of 2,600 feet southeastward 5 miles from the Calawawa.

"CALAWAWA RIVER.—The distance between the Calawawa and Candelaria is only  $1\frac{3}{4}$  miles; and between there is a small ridge of red cliffs. The former stream discharges through the breach, and the entrance is pointed out by two cocoanut trees on the western point and by some red cliffs topped with trees about three-fourths mile to the westward.

"The Calawawa is navigable for canoes about 20 miles, and beyond this a footpath or bridle road leads over the mountains to the capital of the province. The journey may be performed in about thirty-six hours, and the mode of conveyance is on the shoulders of Indians, who accomplish it with great ease and rapidity, even in the midst of incessant torrents of rain, which prevail at almost all seasons.

The red cliff westward of the Calawawa is skirted by a coral ledge, extending off about one-fourth mile. From thence the beach extends westerly for  $2\frac{1}{2}$  miles to Coaita Point.

"A mile westward of the above-mentioned cliff the sand projects out a little to a point, from which a ledge extends off one-fourth mile, and shelters a landing place to the westward of it, near a hut on the beach.

"CANDELARIA RIVER.—On each point of the entrance there is a single cocoanut tree, and on the western point there are also two or three huts; it is also further marked by a house standing on a slight elevation just above the mouth of the river.

"THE COAST.—Three-fourths of a mile to the eastward of Candelaria River is a bold, rocky headland, close under which lie two little rocky islets having foul ground one-fourth mile outside. The shore then extends  $1\frac{1}{2}$  miles to the eastward, presenting dark, sandy beaches, separated by small rocky shelves, when it terminates at the base of a range of most remarkable cliffs, which rise boldly from the sea to the height of between 100 and 200 feet and extend  $2\frac{1}{2}$  miles in a westerly direction. These cliffs appear to be composed of red indurated clay impregnated with minute metallic grains, which have become so highly polished by attrition of the water unceasingly trickling over them from the highlands in the rear that when the sun shines on them from a low altitude a most dazzling appearance is produced. They sometimes look like the white sails of a vessel, and the easternmost has been likened to the stern of a large ship. They are certainly most striking objects and valuable guides to the coasters.

"From these cliffs the shore trends easterly  $1\frac{1}{2}$  miles to Wasora River; it is sandy and intersected by two rocky shelves. From the entrance of the Wasora, which is very small, the coast curves slightly to the northeastward for about 2 miles to a bluff which lies a short distance westward of the Coccoyah River. The shore is a sandy beach, divided in the middle by a small rocky point.

"ZAPATERO POINT is low and sandy and breakers extend from it about one-half mile. At  $1\frac{1}{2}$  miles beyond the point is a very remarkable red cliff 100 feet high. At  $1\frac{1}{2}$  miles to the eastward of the cliff the Gold River empties, and from here the shore trends about east-northeast for 4 miles to the west entrance of St. Christopher Bay, and is sandy and skirted by

a ledge, which breaks nearly one-half mile off. About midway the beach projects a little, and near this spot there is a solitary hut. About one-half mile to the eastward of the Gold River the beach is broken by a small low rocky point.

"GOLD OR CONCEPTION RIVER.—There is said to be a gold mine near the source of this river, from which it is named. The entrance may be distinguished by a remarkable umbrella-shaped tree standing on rising ground on the eastern bank, to the eastward of which, on a small cleared spot, there is a house, and below it on the beach are two cocoanut trees at the mouth of the river. The opening of the valley is also very conspicuous.

"CASTLE CHOCO is a remarkable mountain, rising almost perpendicularly on its northern face from the plain to an elevation of 6,342 feet; the flattened summit has the exact appearance of a huge square castle, with a small tower at one angle. It is, however, so constantly enveloped in clouds as to be seldom visible, except at the break of day, just before sunset, or on a sudden cessation of heavy rains, when the atmosphere will almost instantly become most remarkably bright and clear; and these remarks are applicable to all the highlands on this coast.

"When visible the castle is, of course, an excellent guide for the mouths of the small streams to the westward of the Coclet; it is also to be seen, under favorable circumstances, from the castle of San Lorenzo, at Chagres, west, distant 67 miles.

"From the base of Castle Choco irregular masses of wooded hills begin to rise, and, taking a northwest direction, reach an elevation of 3,100 feet only 5 miles south of the Cocooyah. Thence the base of the Cordillera almost bounds the shore, as far as its northwestern extremity, near the meridian of the Chiriqui River, 35 miles to the westward of Zapatero Point.

"CORDILLERA OF VERAGUA.—Between the Cocooyah and Belen rivers the interior is comparatively low, forming a deep valley for some distance to the southeastward, and the land declines in height toward the coast, where it is elevated about 150 feet; but only 2 miles to the southward of the Cocooyah the northeastern extremity of the base of the Great Cordillera of Veragua rises abruptly 1,044 feet. The highest ridge in this immense mass of mountains traverses the Isthmus from

east to west, for about 70 miles, at the distance of about 15 miles from the coast.

"The Saddle de Veragua, the eastern extremity of the ridge, rises from the low plain of Panama, south, about 20 miles from the entrance of the Coclet River, and, when seen from the northwest, forms a remarkable double peak or saddle 3,326 feet high.

"ST. CHRISTOPHER BAY.—To the westward of Palisado Point the shore forms a sandy bay  $2\frac{1}{2}$  miles wide and a mile deep, into which Old Veragua River empties.

"The river has a hut on the east point of its entrance, and on the rising ground on the west side, in the center of a cleared space, having the appearance of a green plain, there is a conspicuous white house.

"THE COAST.—From Palisado Point, off which breakers extend one-half mile, the shore extends easterly for  $1\frac{1}{2}$  miles in a straight sandy beach, then is rocky for about one-half mile to the Belen River, the opening to which is so small that it is only recognized by the receding of the low hills which form its valley. About 4 miles farther on is the entrance to the Palmillo, which is pointed out by two huts on the eastern side, but is so hidden by dense foliage that it is extremely difficult to find. From this river to Rincon Point the shore trends about northeast for 6 miles and is a sandy beach, intersected by low rocky shelves; the land near the shore gradually declines in height.

"RINCON POINT is a bold, scarped, rocky headland, reaching the height of 550 feet three-fourths of a mile inland. At 3 miles south of it the elevation is 800 feet. Abreast this headland the edge of soundings is only  $2\frac{1}{2}$  miles distant, and the shore is so bold that there are 24 fathoms one-half mile off.

"COCLET RIVER AND MOUNTAIN.—The Coclet River is pointed out by two huts on the west point of entrance and a house in the middle of a small cultivated spot on the east side. Behind it rises the Sierra de Coclet, which, at 4 miles to the southward of the river entrance, reaches an elevation of 1,432 feet. This large mass of irregular hills is connected with the Sierra de Miguel de la Borda by a wooded ridge from 800 to 900 feet high. A little to the eastward of the Coclet the base of the sierra rests on the shore, and continues to bound it until interrupted by the valley of the Plantain River.

"From the Coclet the coast trends about east-northeast 11

miles to the entrance of the Mangalee, and is bounded by a sandy beach, intersected occasionally by small patches of low rocks. About 5 miles from the Mangalee a slight bay is formed for about 2 miles, into which the Plantain River flows; the entrance is marked by a single hut on either side and the deep valley through which it runs.

“MANGALEE RIVER.—From the entrance of Mangalee River, which is pointed out by two or three huts on the west side and a little low rocky point on the east side, to the village of Gicacal, the sandy shore, backed by low rocks, extends for  $2\frac{1}{2}$  miles.

“The whole line of shore between these points is fringed with coral, to a distance of from 200 yards to one-half mile, upon which the sea breaks, rendering landing extremely difficult and dangerous, except under most favorable circumstances.

“All the streams from the Mangalee to the Indios are navigated by small canoes, conveying the sarsaparilla collectors to their banks to the small trading vessels which occasionally call for it.

“The Mangalee defines the northwestern boundary between the provinces of Veragua and Panama.

“ANCHORAGE.—There is temporary anchorage all along the coast just described, in 6 to 8 fathoms, sand and mud, about 2 miles from the shore.

“PILON DE MIGUEL DE LA BORDA.—This remarkable isolated mountain, 1,669 feet high, is situated southwestward 28 miles from the mouth of the Chagres and about 14 miles inland. It is not, however, often visible, being generally concealed by the dense vapors which hang over the extensive low, flat surrounding plain; still it may be occasionally seen from the Chagres anchorage.

“ASPECT.—Immediately behind the entrance of the Mangalee the base of Sierra de Miguel de la Borda attains, almost abruptly, the height of 592 feet, whence it continues to rise in irregular densely wooded ridges to the summit, which is 1,552 feet above the sea and S.  $18^{\circ}$  E. (S.  $23^{\circ}$  E. mag.) 5 miles from the entrance of the river. The Pilon de Miguel de la Borda lies southward and eastward of Giscal village, but is not visible to the westward of it. Abreast the middle of the red cliffs, eastward of Gicacal, there is a conspicuous round hill 356 feet above the sea. Near the entrance of the Indios

the land is about 150 feet above the sea, and to the westward it gradually rises.

"THE COAST from the Mangalee River extends about east-northeast for 14 miles to the Indios River. About  $2\frac{1}{2}$  miles to the eastward of the Mangalee River is the village of Gicacal, which consists of a few straggling huts on the left bank of a small stream. Half a mile to the eastward of the village is a remarkable ridge of low red indurated mud cliffs, which extend for about 3 miles; thence to the Indios cliffs the shore for 2 miles is a low rocky shelf, upon which will be seen a few huts, and then a sandy beach. About one-half of a mile to the westward of the river is a remarkable cavern in the cliff, and at the same distance to the eastward is the village of Salud. From the river to Lagarto village the shore is low, sandy, and thickly wooded behind. At 4 miles northeastward of the village is Diego Point. From here the land gradually ascends to the base of the Chagres table-land. Diego Point is formed by a low rocky shore, and about a mile to the westward of its extremity is a remarkable white cliff, with a small sandy beach on either side, above the western end of which there is a cleared space and grazing farm. Morrito Point is formed by a low red cliff, upon which are a few huts, and foul ground extends from it about 400 yards.

"From El Morillo, a little rock about one-half of a mile eastward of Morrito Point, the shore is rocky and foul to Arenas Point, at the entrance of the Chagres River, with Boca de la Furnia Point in between.

"CHAGRES RIVER.—The flat rocky promontory which bounds the north side of the entrance to the Chagres River is about 400 yards in length east and west and about 175 yards broad. On the north, west, and south sides it rises almost perpendicularly from the sea to the height of 82 feet at the outer end and to that of 100 feet at the inner part. The western part is occupied by the fortifications of San Lorenzo, now in ruins, immediately in the rear of which there is a level plateau 300 feet in length, terminating at a little mound commanding the valleys on all sides and the only road to the castle. The works are everywhere in a state of decay and the buildings almost in ruins.

"The south side of the entrance to the river is formed by a dark sandy beach, and from Arenas Point to the base of the promontory opposite the width is 225 yards. From the inner

end of the promontory the shore turns suddenly to the southward, and abreast Arenas Point the river is only 100 yards wide.

“The bar has 11 feet of water in the dry season, but the depth changes according to the state of the river. The mouth of the river, outside the bar, is obstructed by the Laja Reef, a rocky ledge about 50 yards in diameter, which breaks in heavy weather and is nearly even with the surface of the sea. The best approach is northward of Laja Reef in depths of 14 feet over a breadth of about 70 yards. Within the bar the water deepens to 17 to 20 feet abreast the town, which is 200 yards above the bar. Here is the anchorage for vessels that can enter. Small craft also lie alongside the bank of the river southward of the town, as the shore at the town is a rocky ledge.

“Reefs nearly awash, one-fourth of a mile in extent, which also break during strong winds, lie from one-third to one-half of a mile westward of Arenas Point, with shallow water extending toward the Laja. The passage between, though with 14 feet of water, is narrow and not recommended.

“CHAGRES.—The town of Chagres is on the eastern shore, between the Castle and Caño Rivulet, which enters the river abreast Arenas Point. The shore in front is skirted by a flat rocky ledge, so that small craft find it more convenient to lie alongside the bank just above the Caño. Since the completion of the Panama Railroad Chagres has become simply a fishing hamlet and retains no evidence whatever of its former size and importance. A few thatched huts and a population of 200 souls comprise the whole.

“ANCHORAGE.—The anchorage off Chagres is an open roadstead, exposed from northeast, round northerly to southwest. In the latter direction, however, it is somewhat protected by the distant land and bank of soundings; but in strong winds from between west and northeast remaining here is attended with risk, and it will be better when the weather threatens from these quarters to put to sea or proceed to either Colon or Porto Bello. A good berth will be found with the castle of San Lorenzo bearing S. 56° E. (S. 61° E. mag.), and the rock of Mogote de Brujas just open of the bluff N. 45° E. (N. 40° E. mag.) in 10 fathoms, mud, about 1½ miles from the shore, but a position farther in may be taken if necessary.

"CURRENT.—The current usually sets northeastward with a velocity of about 1 knot an hour.

"GENERAL DIRECTIONS—APPROACHING COLON AND CHAGRES.—Approaching from the northeast in the season of the breezes, from November to May, the first land seen will be most probably the lofty flat mountain ridge of Llorona, overlooking the harbor of Portobelo from the southward, at the height of 3,000 feet. The shore is very low to the westward of Portobelo until it reaches the little flat peninsula of Chagres, and it is of the same character to the westward of that river for a distance of about 25 miles; therefore the locality is well marked by the peninsula and easily made out. The interior is so generally shrouded by the rains and deadly vapors arising from the swamps that the inland chain of the Calderos Altos is seldom visible. The Sierra de Llorona is also frequently obscured, but the irregular hills which inclose Portobelo are generally unclouded, and, being from 600 to 1,300 feet high, are sufficiently remarkable to be distinguished from the much lower table-land of the Chagres Peninsula.

"As the land back of Manzanillo is high and can be seen from 40 to 60 miles off, according to the state of the atmosphere, it forms a splendid landmark, and no allowance for the easterly set is made by most of the captains of mail steamers; as, should the current happen to be slight or no current at all be encountered, as sometimes happens, and allowance were made for the easterly current, a vessel would make the low land to the westward of Colon, where it is difficult to recognize. By making no allowance, a vessel is sure to make the high land of Manzanillo, or that between Manzanillo and Colon.

"The islands off Manzanillo Point are nearly all covered with trees and can not be easily distinguished until after a vessel is within a few miles of the coast; but the large bare rock, Farallon Sucio, the largest islet of the group of this name, is a splendid landmark from all directions and can readily be distinguished, since it is comparatively bare of vegetation. It is not unlike in appearance to Green Island, off Portobelo; but the latter, being covered with trees, can not be distinguished from the mainland at a distance, and, besides, it is much smaller and not so far offshore as Farallon Sucio.

“Captain Lima, of the Pacific Mail steamship *Newport*, states that in 90 voyages from New York to Colon he has always made Sucio, off Manzanillo Point, bearing S. 16° W. (S. 11° W. mag.) to S. 19° W. (S. 14° W. mag.), even in the rainy season, when no observation could be obtained. His invariable rule is to change his course, so as to allow for the easterly set near this coast, as soon as he sights logs, trees, and driftwood. At his speed of 12 knots he allows one-half to three-fourths of a point, according to the quantity of driftwood encountered. If the quantity of driftwood is very great and the discoloration of the water very marked, he sometimes allows as much as 1½ points. If he encounters no drift he makes no allowance and assumes that there is no current.

“Off Manzanillo Point numerous tide rips have been observed and the current found to be 1½ knots per hour setting eastward. A current close in to the coast, as strong as 2½ knots per hour, has often been found.

“In the other part of the year, when calms and variable winds prevail and the easterly current is most powerful, it will be better to keep an offing from 30 to 40 miles and to make the coast even to the westward of Chagres. By doing this a vessel will not only avoid the strength of the current, but in a great measure escape the heavy rains and violent squalls from the shore.

“In this case the locality of the river is pointed out by a remarkable piece of flat wooded tableland, about 3 miles in diameter, which lies not far inland on the west bank of the river. Its north side rises rather abruptly to a height of 800 feet, and the elevation of its summit does not alter more than about 30 feet in its whole extent. There is nothing like it in the neighborhood. The land behind Chagres being higher than at the entrance, the castle is not seen from the westward until within a short distance.

“In leaving Chagres or Colon and bound to windward it will be, of course, advantageous to work or run alongshore in the influence of the great eddy stream, which generally reaches as far up as Cartagena. In the season of the variables and hazy weather, however, great care is requisite, particularly at night, for the stream runs close to the islets of Portobelo, and both hand and deep-sea leads should be well attended. It is also necessary to warn the navigator to be

well prepared to meet the violent gusts from the high lands at this period and to anchor should it fall calm.

“COAST.—From the bluff at the entrance of the Chagres River to Brujas Point the shore extends nearly straight north-northeast 3 miles, and is rocky and steep-to. About midway, however, there is a small rocky cove, into which a rivulet falls over the cliff from a height of about 30 feet. The water is excellent, but the heavy surf prevents landing anywhere near it.

“On the north side of the bluff of Chagres there is also a small sandy cove named ‘Laja,’ about 200 yards wide and having a depth of 15 feet close to the beach, into which a little stream flows at the southeast corner, by the side of the precipice. The north side of this cove is bounded by a bold irregular bluff headland, rising to the height of 120 feet, and, being higher than the bluff, hides the castle of San Lorenzo from the northward until the latter is brought to bear S. 17° E. (S. 22° E. mag.).

“Brujas Point is a bold, rocky, wooded headland, from whence rises the highest part of the peninsula. At the foot of the cliff, and only a few yards distant, is a small, isolated rock, with perpendicular sides, crowned with bushes, called the Mogote de Brujas, which, when seen open of the bluff, is remarkable. The rock is connected to the bluff by a flat ledge, dry at low water, extending outside it about 200 yards; it is steep-to. There are 6 fathoms 400 yards from the rock.

“From Brujas Point to Toro Point, the west entrance point of Limon Bay, the coast trends about east-northeast 2 miles. The shore in this space forms a low shelf of rock, intersected near the middle by a small sandy bay, and is skirted at a short distance by a ledge nearly dry at low water.

“TORO POINT, the highest point of the peninsula between Chagres Bay and Colon Bay, is about  $2\frac{1}{2}$  miles broad and 400 feet high. The summit is thickly covered with wood, and is consequently totally different in appearance from the low mangrove coast to the eastward, and this serves to point out the locality from a wide offing. From Toro Point a shallow coral ledge projects north-northeastward three-fourths mile, and is generally marked by heavy breakers. It should be given a wide berth. The ledge also extends one-half mile east-northeastward from the point.

“LIGHT—TORO POINT LIGHT.—On Toro Point, from an iron

tower painted red and white, on stone base, is shown a white light, which shows a flash of five seconds every thirty seconds. The light is elevated 108 feet and is visible 16 miles. The glare of the light has been seen 21 miles. When close to the light, the eclipses are not total.

"COLON, LIMON OR NAVY BAY.—Toro Point is  $2\frac{1}{2}$  miles N.  $79^{\circ}$  W. (N.  $84^{\circ}$  W. mag.) of the Colon light-house, and between them is the entrance of Colon Bay. This bay is  $3\frac{1}{2}$  miles deep from north to south and about 3 miles wide at the head. The depths at the entrance are  $5\frac{1}{2}$  and  $6\frac{1}{2}$  fathoms, whence they decrease to  $4\frac{1}{2}$  fathoms in the middle and 3 fathoms at a mile from the head of the bay, and within this distance they shoal gradually to the beach to the southward. It would appear that the depths in this bay are continually decreasing.

"There are from 26 to 28 feet alongside of the wharves.

"In the season of the north winds, the bay being completely exposed in this direction, a heavy swell rolls in.

"Limon Point, on the west side of the inner part of the bay, stretches a little to the eastward, and affords shelter under its south side in Limon Harbor for small vessels in  $2\frac{1}{2}$  fathoms of water.

"MANZANILLO ISLAND, which is about a mile long north and south and three-fourths mile broad, is very low, and for the most part covered by mangrove brushes. It is separated from the main by the Boca Chica, a narrow boat channel leading into the harbor. Its eastern portion is known as the Boca Grande. A coral reef skirts the north and north-west ends of the island to the distance of 200 yards. Reefs extend also off the entrance points to the Boca Chica, from 200 to 400 yards. A bridge of the Panama Railroad Company connects the island to the main.

"LIGHT—COLON LIGHT.—On Manzanillo Point, the north-western extremity of Manzanillo Island, a fixed white light is exhibited on the top of an open framework at an elevation of 60 feet, and should be visible in favorable weather at a distance of 10 miles. It is often difficult to distinguish this light from the ordinary white light carried by steamers.

"BUOYS.—A buoy has recently been moored by the Panama Railroad Company in  $5\frac{3}{4}$  fathoms, Colon light-house bearing N.  $60^{\circ}$  W. (N.  $65^{\circ}$  W. mag.), distant one-sixth mile, and Toro light-house bearing N.  $88^{\circ}$  W. (S.  $87^{\circ}$  W. mag.), distant

2½ miles. Vessels should not pass between this buoy and the reef. Several buoys are also placed off the wharves for the convenience of wharfing or mooring. These, together with the Panama Canal buoys, are the only buoys in the harbor.

“DIRECTIONS.—There are no known dangers in the approach to Colon Bay other than the reef extending from Toro Point. The chart shows a 4½-fathom spot, position doubtful, about three-fourths mile N. 28° E. (N. 23° E. mag.) of Manzanillo Point light.

“ANCHORAGE.—The best anchorage in ordinary weather is abreast the Pacific Mail Company's dock, about 600 yards off, but in bad weather it is better to anchor on the opposite side to avoid the heavy sea that rolls in around Toro Point. The holding ground is good, but there are many anchors and cables strewn about the bottom.

“TIDES.—There is a rise of tide about 18 inches to 2 feet in Limon Bay, according to the winds, but the time is uncertain.

“NORTHERS.—These winds occur in November, December, and January. They are seldom violent, but a heavy sea rolls in.

“At Colon a norther is not necessarily a gale of wind; in fact, the wind frequently does not blow home, and is at times quite light, but very heavy ground swell heaves into the bay. When the wind does blow home, as happened during the norther of December 19–21, 1890, no vessel can remain at anchor with safety. There is no way of predicting these dangerous northers. The barometer gives no indication. The ‘fitful showers of rain in large drops’ may or may not be an indication. The gradually increasing swell, supposed to be a forerunner of a norther, frequently proves to mean nothing.

“The norther of December 19–21, 1890, was preceded on the 18th by a heavy swell and threatening weather, but toward evening the swell decreased, the weather cleared, and it looked like a fine night. Later in the night the swell commenced to heave in with greater force, so that steamers were compelled to leave their wharves. It was not till after daylight on the 19th that the full force of the norther began to be felt, and in a very short time it became so rough that all steamers put to sea. The Pacific Mail steamer *Newport* cut her lines and steamed across the bay to the anchorage under the lee of Toro Point, but was soon compelled to abandon this anchorage and put to sea. One steamer, lying in the

harbor with two anchors down, dragged nearly 1 mile before she could get sufficient steam to be able to slip and go to sea.

"During the season of norther steamers should keep steam up constantly and be ready to move at a moment's notice. This is the custom of steamers of all nations which touch at this port, regardless of the time they may remain. However long the weather may have been threatening, when the norther does break it comes suddenly and leaves no time for preparations. If compelled to get under way the surest way is to slip the chain and steam out to sea. It would be almost impossible to get up anchor without damage to the ship at such times, and there is always a risk of hooking one of the old anchors and chains with which the bottom of the harbor is strewn.

"COLON (ASPINWALL), on the west side of Manzanillo Island, is connected with Panama,  $47\frac{1}{2}$  miles distant, by rail. It is almost entirely a port for a few lines of regular steamers running on through arrangements with the Panama Railroad Company, carrying cargoes destined principally for transit to and from the Pacific. The town stands on a low island which was originally covered with morass and jungle; there is no drainage possible of any value, and the malarial exhalations of the surrounding swamps, coupled with the emanations of the town, produce a condition of things most undesirable. There was a floating population of about 3,000 in 1901, composed principally of employees of the Panama Railroad Company, whose headquarters are at Colon. On account of better sanitary conditions the health of Colon is said to be somewhat improved of late.

"The United States is represented by a consul and vice-consul. The port is free.

"COLON APPROACH—SHOAL NORTHWARD OF MANZANILLO POINT.—Lieut. Commander W. R. Rush, of the U. S. S. *Marietta*, reports under date of March 11, 1902, having located a dangerous shoal about a mile northward from Manzanillo Point, east side of entrance to Colon Harbor.

"The *Marietta* anchored on the shoal in  $4\frac{1}{2}$  fathoms and used two boats in sounding out the hummock in radial lines from the bow of the ship, crossing with parallels.

"The least water found was 23 feet, in one spot. From this depth of 23 feet the water rapidly deepened on all sides to 7 fathoms.

"The 23-foot spot is on the following bearings: Manzanillo Point S.  $10^{\circ}$  E. true (S. by E.  $\frac{1}{4}$  E. mag.) Toro Point light-house S.  $77^{\circ}$  W. true (WSW.  $\frac{1}{2}$  W. mag.). (Variation  $4^{\circ}$  E. in 1902.)

"Lieut. Commander W. V. Bronaugh, of the U. S. F. S. *Kearsarge*, reports under date of March 11, 1902, that the  $4\frac{3}{4}$ -fathom shoal shown on Hydrographic Office chart No. 1008, about two-thirds of a mile N.  $15^{\circ}$  E. true (N. by E. mag.) from Manzanillo Point light-house and marked 'P. D.' does not exist in its assigned position. Soundings taken March 11 over the assigned position of the shoal showed a least depth of 35 feet in the vicinity.

"COLOMBIA—COLON—BUOY OFF MANZANILLO POINT.—Lieut. Walter McLean, of the U. S. S. *Machias*, reports under date of May 15, 1902, that there is but one buoy off Manzanillo Point, entrance to Colon Harbor. This buoy is a large can buoy with spindle and vane painted a drab color. It is on the following bearings: Toro Point light-house N.  $78^{\circ}$  W. true (W.  $\frac{5}{8}$  N. mag.). Statue on Christobal Colon Point S.  $15^{\circ} 30'$  E. true (S. by E.  $\frac{3}{4}$  E. mag.). Manzanillo Point light-house N.  $85^{\circ}$  E. true (E.  $\frac{1}{4}$  N. mag.).

"COLON — PANAMA CANAL ENTRANCE — SOUNDINGS — BUOY.—Lieut. Commander A. E. Culver, U. S. Navy, commanding the U. S. S. *Bancroft*, reports under date of March 8, 1903, that he took soundings at the entrance to the Panama Canal to ascertain if it were practicable to take the *Bancroft* into the entrance of the canal during the season of northers. He found the soundings just about 1 fathom less than corresponding soundings shown on Hydrographic Office chart No. 1008.

"Of the buoys shown on this chart marking the entrance to the canal only one now remains, viz, the first black buoy bearing S.  $57^{\circ}$  E. true (SE. by E.  $\frac{1}{2}$  E. mag.) from the statue on De Lésseps Point.

"SUPPLIES.—Fresh meats, vegetables, and fruit are scarce and of poor quality. Preserved provisions can be had in limited quantities.

"WATER can be obtained from the Panama Railroad Company at  $1\frac{1}{2}$  cents gold per gallon, delivered in tanks on the wharf; it is taken from the river and must be thoroughly filtered before being used.

"COAL.—American and English coal can be had from the

railroad company alongside the wharf. The price is high. Coal may also sometimes be obtained from a vessel in the harbor at a much less cost.

“CHARGES.—Vessels entering the harbor are charged light fees, 5 cents per ton for first 100 tons,  $12\frac{1}{2}$  cents for every additional ton, and in coming to wharf, wharfage in proportion to tonnage, as per printed rates of the Panama Railroad Company. Tonnage dues, \$1 per ton. Ships landing cargoes at Colon for the Isthmus of Panama must present to the inspector of the port a general manifest of all cargoes to be landed, also a copy of every invoice with the certificate of the Colombian consul at the port of shipment. This does not apply to cargoes in transit.

“PILOTAGE.—Not compulsory, from \$15 to \$30 (all charges payable in Colombian currency).

REPAIRS.—The railroad company's machine shops offer facilities for repairs.

“COMMUNICATION.—There is regular steam communication with various ports in the United States and Europe, as well as with Central and South American ports. Vessels of the Pacific Mail Company ply between Aspinwall and New York three times a month each way. There is telegraphic communication with the United States via Jamaica, and also via Panama and Vera Cruz.

“WHARFAGE.—The wharfage is ample, and large steamers find sufficient water (26 to 28 feet) to go alongside the wharves to embark and discharge. There is a boat landing at the northern wharf only.

“CLIMATE.—The Panama Canal district is one of the hottest, wettest, and most feverish regions in existence. Intermittent and malignant fevers are prevalent, and there is an epidemic of yellow fever at times. The death rate under normal conditions is large.

“RAINY SEASON.—The rainy season is from the end of April to the end of December, and almost incessant from June to the latter month. In 1889 the rainfall amounted to 119 inches, the greater portion of which fell during a period of four months.

“PANAMA CANAL.—The proposed enlarged port of Colon, northern entrance to the intended Panama Canal, was begun on the south shore of the Boca Chica, and the northern point of entrance to Boca Chica, named Terre-plein, was reclaimed

for the purpose of erecting workshops and stores and to cover the entrance of the intended canal. The canal, 46 miles in length, was begun in sections in 1882 and continued for several years. In March, 1889, the original Panama Canal Company was forced to go into liquidation for lack of funds and to suspend payment and all operations on the canal. In 1894 a new company was formed, which obtained a concession for ten years, extended in 1900 for six years, so as to terminate in 1910. By that time, according to the annual report of 1899, the canal could be completed at a cost of about \$100,000,000.

“MANZANILLO BAY.—Between Manzanillo Island and the main a small harbor is formed, which has a depth of from 4 to 2 fathoms. At the entrance, which is three-fourths mile wide, there is an anchorage in 5 fathoms, sand and clay, about one-fourth mile from the eastern shore, with the west end of Margarita Cay just open to the westward of Coco Solo Point, bearing N. 6° W. (N. 11° W. mag.).

“THE COAST.—Longarremos Point is formed of low mangroves and bordered with reefs to a distance of somewhat more than 200 yards, having 11 fathoms of water close-to. About 5 miles east-northeast of the point are the Naranjos Cays, covered with trees and surrounded by reefs. To the westward of them is anchorage in 4 to 7 fathoms, mud.

“Between the point and cays the mangrove shore is very irregular, and forms two bights or creeks, named ‘Minas;’ the eastern extends inward to the south-southeast about 3 miles, but varies in breadth; the western runs into the southward about a mile, and is much narrower than the other, and the shore of both are fringed with coral.

“These cays are near the entrance to the Grande River, and from here the coast trends about northeast by east 5 miles to Gorda Point, the land gradually diminishing in height from the point to the river, and westward of the river is very low and bounded by mangroves. From the point the coast trends to the northeast to Buenaventura Cove about one-half mile to the southward of Cocal Point. The cove is so obstructed by reefs as to be of little use.

“PORTOBELO (Porto Bello) is one of the best harbors west of Cartagena. The port being, however, inclosed to the north and south by hills ranging from 600 to 1,300 feet high, shutting out the regular breezes, and bounded on the east by dense swamps, the position is exceedingly unhealthy, and the

port is now of little commercial importance. The forts and government buildings have fallen into decay. The population in 1882 numbered about 500.

"The north side of the port is formed by a narrow irregular island, nearly  $1\frac{1}{2}$  miles in length from east to west, of moderate elevation, and steep-to. The south shore is bounded by the base of the mountains, which rise, not far inland, to a height of 1,300 feet, and are seldom unclouded. This side is foul, being skirted by a coral reef to the distance of 200 to 400 yards, with irregular soundings some distance outside; the depth of the water in the harbor is reported to be decreasing considerably.

"The village of Portobelo and the ruins of the Castle of St. Jeronimo are situated on the beach, in the southeast corner of Portobelo. There is a sand bank of 6 feet water extending in a northerly and westerly direction from the castle. On the north shore, opposite the town, are the ruins of San Fernando Castle, hidden by bushes.

"Off Cocal Point, the southwest point of the port, are three small islets, the outermost and largest named 'San Buenaventura,' lying 600 yards southwestward of the point. Foul ground extends about 600 yards to the westward and northward of these islets; and at this distance, with the northwest point of the outer islet bearing south ( $S. 5^{\circ} E. mag.$ ), and Cocal Point  $S. 55^{\circ} E. (S. 60^{\circ} E. mag.)$ , is the Farnesio Shoal, of 4 fathoms, within which there is no safe passage.

"At the head of the port a sand bank stretches off about 500 yards from the mangroves, leaving a channel on the north side into the careening cove, which has depths of 3 or 4 fathoms.

"Between Portobelo Point and San Buenaventura Islet the width of the entrance is  $1\frac{1}{2}$  miles; but a short distance within this, between Iron Castle Point and the south shore, it is about one-half mile wide; this breadth is carried up for about a mile, to the head of the harbor, and the depth gradually decreases from 17 to 7 fathoms, close up to the edge of the sand bank.

**GREEN ISLET.**—At 300 yards southwestward of Portobelo Point is Green Islet, little more than 100 yards in extent from east to west, and having a break in the middle which appears at a certain distance to divide it into two parts. It is clear all

around, but the passage between it and the point is not safe for large vessels.

**SALMEDINA BANK.**—At one-fourth mile west of Green Islet is the Salmedina Bank, on which the sea breaks in two distinct patches. It is composed of rock, about 100 yards in extent, dry at low water, with 6 fathoms close around; in the channel between it and the islet there are 16 to 21 fathoms, clay. The bank has been reported as lying N. 79° W. (N. 84° W. mag.), three-fourths mile from the position assigned.

**"DIRECTIONS FOR PORTOBELLO.**—The wind generally blows out of Portobelo, or is light and baffling, according to the seasons; a vessel will therefore most probably have to work or tow in. In approaching from the northward it is advisable to leave the Duarte Islets about one-half mile to the eastward, thence avoiding the position of the rock charted off Mantilla Point, steer to pass about 200 yards, or with a steady breeze even less, from Green Islet, to avoid the Salmedina.

"Having passed the islet, the vessel may keep close to the wind, with the north shore aboard, and in the season of the breezes she will fetch into the middle of the harbor. After passing Iron Castle Point, in working up, when standing to the southward, no part of the town must be shut in with the land to the westward, to avoid the ledge off the south shore. An anchorage may be taken up as most convenient, for with the exception of the above ledge, there is no known danger.

"When approaching from the westward it is recommended to keep the shore about 3 miles distant; and in the night the soundings should not be neglected, as between Chagres and this port they extend from 8 to 10 miles. From this direction the entrance is made known by two remarkable trees on the top of the hill on the south side and a signal post upon a hill on the north side of the harbor; the continued existence of either, however, is very doubtful, but from this quarter the opening itself is sufficiently remarkable. In standing toward the San Buenventura Islands Green Island must not be opened to the westward of Portobelo Point or brought to bear to the northward of N. 28° E. (N. 23° E. mag.), and in standing toward the Farnesio Shoal from the northward the northernmost extremity of the lines of St. Jeronimo castle must be kept well open of the land.

“ From May to November light breezes from the southwest and west with heavy rain prevail in the harbor, but toward morning there is a light air from the northeast; therefore, in leaving, vessels should be prepared to get under way at day-break, with boats ahead to tow.

“ It is also to be observed that the northeasterly current runs strong close to the entrance of Portobelo, and in the rainy season at least  $1\frac{1}{2}$  knots an hour as far as Farallon Sucio. Sailing vessels, therefore, should make the port from the westward, more particularly during the months of August to November.

“ PORTOBELLO (PORTO BELLO) POINT, the northwest point of the entrance of Portobelo, bears S.  $20^{\circ}$  W. (S.  $15^{\circ}$  W. mag.)  $2\frac{1}{4}$  miles from the northernmost part of the Duarte Islets. The coast is high and scarped, and close westward of Mantilla Harbor is a small harbor called Leon, of not much importance, the entrance being almost blocked up by reefs and a small island at the mouth.

“ ROCK.—Midway between the Duarte Islands and Portobelo Point and 700 yards offshore there is a rock which always breaks. José Pobre Point is just open off Sabanilla Point N.  $56^{\circ}$  E. (N.  $51^{\circ}$  E. mag.) when near it.

“ SABANILLA POINT is fringed by a reef and some rocks, the adjacent coast is high and scarped with some bays, and José Pobre Point, N.  $61^{\circ}$  E. (N.  $56^{\circ}$  E. mag.),  $1\frac{1}{2}$  miles from Sabanilla Point, projects a short distance.

“ DUARTE ISLETS are four in number, extending north-northwest and south-southeast three-fourths of a mile. From the northernmost islet a reef extends in a northwesterly direction about 200 yards. The southernmost islet is separated from Duarte Point on the main by a channel a little more than 400 yards wide, and from Sabanilla Point by a channel a little more than one-third of a mile across; between these two channels there are from  $2\frac{3}{4}$  fathoms water close to the islet to 15 fathoms toward the main. The southeast side of the island is fringed by a reef to the distance of 100 yards or more.

“ FARALLON SUCIO is the name given to the westernmost of a cluster of five small rugged rocks, which occupy a space of about one-fourth of a mile from east to west. It appears to be steep-to, but from the easternmost rock a foul ledge

extends 300 yards to the southeast. The northernmost islet lies west nearly 4 miles from Tambor Island, with 16 to 30 fathoms clay and sand between, and 16, 21, 22, and 25 fathoms between the north islet, the islets off the coast, and Lavadera Shoal. These rocks appear from a distance as one islet, which is remarkable for its barren whiteness. This contrast with the Duarte Islets, which are dark, or the mainland, makes them an excellent landmark from all directions.

“BOQUERONES POINT is high, salient, and scarped. About a mile to the southward Casique Hill rises to a peak of moderate height. Northeastward of the point there are five small islets named the Boquerones, about 600 yards in extent, which are the westernmost of the reefs and cays that extend from Pelado Islet.

“GARROTE HARBOR.—At  $2\frac{1}{2}$  miles southwestward of the highest part of Tambor Island is the entrance of Garrote Harbor, which is formed on the south side by the mainland, on the east by Great Garrote Island, and on the west by Pelado and other islets, which extend westward for about  $1\frac{1}{2}$  miles to the mouth of the Boquerones. The entrance, which is scarcely 600 yards wide between the reefs westward of Great Garrote Island and Pelado Islets, runs in a southerly and southeasterly direction, with depths from 12 to 18 fathoms, mud, decreasing to  $6\frac{1}{2}$  fathoms within.

“BASTIMENTOS HARBOR, although with depths of  $3\frac{1}{2}$  to 7 fathoms and sheltered, is of little importance. All its shores are bounded by reefs, and the customary anchorage is to the southwest, south, and southeast of the south or sandy point of Bastimentos Island.

“BASTIMENTOS ISLAND is nearly a mile in length northeast and southwest, and forms, with the mainland, the northeast channel of Bastimentos Harbor, which is about 300 yards wide between the reefs, with 5 and  $5\frac{1}{2}$  fathoms, sand. The island is foul on its southeast, south, and southwest sides; the latter, with Cabret Island, which bears a little to the south of west, forms the northwest channel, 600 yards wide in the narrowest part between the reefs, and carries from  $3\frac{1}{2}$  to 9 fathoms, mud.

“LAVADERA SHOAL, northward, nearly three-fourths of a mile from the northern extremity of Pelado Islet and west 1 mile of Cabret Islet, at the mouth of Bastimentos Harbor, is composed of rock with very little water on it, and steep-to.

There are 7 and 9 fathoms close to a rock, on which the sea breaks. The channels between it and Cabret and Pelado islets carry from 14 to 17 fathoms on mud.

"MOUNTAINS.—Between Garrote and Bastimentos harbors is the hill of Garrote, tolerably high, its summit terminating in a peak, about three-fourths of a mile from the coast. At  $3\frac{1}{2}$  miles about south by east of the little bay of Garrote is the high mountain of Capira, almost always covered with clouds. It is nearly east from Porto Bello.

"At a short distance to the southward of Capira are the Sierras Lloronas, extending nearly east and west. The eastern part of its summit appears as if cut down vertically, forming a peak, named Campana, or the Bell, and from this peak the ridge descends gradually to the westward to near the peak of Guanche. The Llorona is the highest range on this part of the main, its summit reaching an elevation of 3,000 feet, and its appearance is such that it can not be mistaken for any other. In clear weather it may be seen from a distance of 45 miles, but in the season of fresh breezes it is generally covered with haze. In the season of the vendavales and variable winds it is often visible between 8 and 9 in the morning and 4 and 5 in the afternoon, but in the remainder of the day it is covered with clouds.

"TAMBOR ISLAND, about  $1\frac{1}{2}$  miles westward from Manzanillo Point, is high, round, and scarped, and connected by a reef 400 yards long, with the northernmost part of Venados or Bastimentos Island.

"MANZANILLO POINT, the northern extremity of the coast of Panama, is a high scarped projection, with two hummocks on it resembling a saddle. Near this point are several islets and a shoal. Martin Pescador, the outermost islet, is about 200 yards in extent from north to south, and lies about a mile eastward of the point. About 800 yards S.  $28^{\circ}$  W. (S.  $23^{\circ}$  W. mag.) of this islet and about three-fourths of a mile from the point is Manzanillo Island, which is the largest. Off the north side of this island are three rocky islets, the farthest out being distant over 200 yards. S.  $28^{\circ}$  W. (S.  $23^{\circ}$  W. mag.) of the same island there are three more small islets, surrounded by reefs extending northeast and southwest, and also to the eastward, about 300 yards, there is another small one. All these islets are high and scarped. Between those of Manzanillo and Martin Pescador there are from 10 to 14 fathoms water.

“MANZANILLO SHOAL, lying northwestward, distant 800 yards from Manzanillo Point, has very little water over it and 5 and 6 fathoms close-to. Between it and the point the depth is 13 fathoms.

“With Manzanillo Point bearing S.  $51^{\circ}$  W. (S.  $46^{\circ}$  W. mag.) and Tambor Island west (S.  $85^{\circ}$  W. mag.) about 4 miles distant, 6 fathoms water, over rocky bottom, have been obtained, deepening to 20 fathoms in a northwest direction.

“LIGHT—ISLA GRANDE LIGHT.—On Isla Grande, off Manzanillo Point, from a white tower is shown a light flashing white and red, alternately, every five seconds. The light is elevated 305 feet and visible 24 miles. The light has been observed to be very irregular in its action, sometimes obscured and sometimes showing white or red only for some minutes' duration.

“SAN CRISTOVAL BAY.—At 5 miles S.  $79^{\circ}$  E. (S.  $84^{\circ}$  E. mag.) of Manzanillo Point, a mile to the eastward of which is the islet of Martin Pescador, is Pescador Point; both are high and scarped. Between these points the shore recedes to the southward, forming a bight about 3 miles deep. At  $3\frac{1}{2}$  miles westward of Pescador Point the shore projects considerably at Cristoval Point, and to the southwestward of this, at the bottom of the bight, is the small foul bay of San Cristoval. About 400 yards northeastward of Cristoval Point is an islet named Juan del Pozo, surrounded by rocks, and about southeast one-half mile from the islet is the Vibora Bank. Between this bank and Juan del Pozo, and between the latter and the point, there are 9, 10, and 13 fathoms water on gravel and coarse sand, and between the Vibora and Buey shoals, off Pescador Point, there are about the same depths on sand and clay.

“From the head of San Cristoval Bay reefs extend nearly a mile toward Cristoval Point. This part is dangerous in strong winds. The coast between Cristoval and Manzanillo points is lofty and scarped.

“NOMBRE DE DIOS HARBOR.—At the east side of San Cristoval Bay, about  $1\frac{1}{2}$  miles southwestward of Pescador Point, is the small cove or harbor of Nombre de Dios. Its mouth has  $3\frac{1}{4}$ , 4, and 5 fathoms, but the entrance points are skirted by reefs, and so is the greater part of the interior.

“CAUTION.—From the numerous shoals which have been pointed out it will be quite evident to the mariner that to

navigate within this bight requires the greatest care and attention, and the leeward part of it should be avoided altogether.

"PESCADOR OR TERRIN POINT is fringed with reefs which extend northward 200 yards and westward one-half mile, and, continuing on in a southerly direction, surround three islets lying between the point and the northeast point of Nombre de Dios Harbor. At 400 yards northwestward of Pescador Point is Pescador Islet, and N.  $62^{\circ}$  W. (N.  $67^{\circ}$  W. mag.), about a mile from the same point, is the Buey Shoal, between which and the reefs skirting Pescador Point there are 9 and 12 fathoms.

"MOUNTAINS.—Among the mountains in this neighborhood two are remarkable, named Saxino and Nombre de Dios. The first is high and terminates in two peaks near each other, the northeasternmost of which bears about S.  $6^{\circ}$  E. (S.  $11^{\circ}$  E. mag.) 7 miles from Pescador Point. The latter mountain rises to a single peak, about south by west 8 miles from the same point, and is a guide for Nombre de Dios Harbor, which is nearly on its meridian.

"ISLANDS.—At 8 miles to the eastward of Pescador Point is Quengo Island, about one-half mile from shore, and 6 miles farther eastward is the small islet of Culebra.

"MOUNTAINS.—The mountains along this coast are sufficiently remarkable and useful objects. The Cerro de la Gran Loma or Gordo, rising southwestward 7 miles from Culebra Islet, being rather more prominent than others in this neighborhood, serves as a mark for keeping clear of the Escribanos bank and shoals. The summit of this hill is of some extent, and appears a little higher than the Cordillera, in which it is situated.

"ESCRIBANOS HARBOR.—Cocos Point is on the east side of the mouth of Escribanos Harbor. Thence the shore to Perro Cay is low and forms something of a bay, skirted by a reef. The most prominent objects on it are Playa Colorado, which is round and skirted by reefs extending off 200 yards; Mogote Point, which is small, a little salient, and has a hillock on it; and Morro Colorado, also round, scarped, and projecting but little.

"Cocos Point projects into the sea, and from it Escribanos Point bears W.  $6^{\circ}$  S. (W.  $11^{\circ}$  S. mag.)  $1\frac{1}{4}$  miles. In the middle of a bay formed between these points is Escribanos Harbor,

extending to the southward one-half mile, and having only from 6 to 9 feet water in it. Outside, off both points, there are very shallow reefs, and in the channel formed by them there are from  $3\frac{1}{4}$  to 6 fathoms.

“**ESCRIBANOS SHOALS.**—About 2 miles northeastward of Escribanos Point there are two rocky shoals lying close together, with very little water over them. The one nearest the coast extends east-northeast and west-southwest about a mile, and has a small islet upon it; the other lies about west-northwest from the islet, and is nearly a mile in extent from east to west; both are steep-to, with 3 and 4 fathoms on them.

“**ESCRIBANOS BANK.**—At  $5\frac{1}{2}$  miles N.  $51^{\circ}$  W. (N.  $56^{\circ}$  W. mag.) of the Escribanos Shoals is the bank of the same name, which extends nearly 2 miles in that direction, and has from 6 to 8 fathoms water over rocky bottom. There is possibly less water. To the northward of this edge 400 yards are 16 to 31 fathoms, and its northwest end bears N.  $34^{\circ}$  W. (N.  $39^{\circ}$  W. mag.) 8 miles from Escribanos Point. Heavy seas generally break upon it, but otherwise a good lookout must be kept from aloft for the discolored water.

“The channel between this bank and the Escribanos Shoals carries from 8 to 17 fathoms water on sand, gravel, and rocks.

“**CORAL SHOAL.**—In 1879 the captain of the mail steamer *Saint Laurent* reported that his vessel touched twice 10 miles from the coast, between San Blas and Manzanillo points.

• **Cape Manzanillo** bore S.  $79^{\circ}$  W. (S.  $74^{\circ}$  W. mag.), and the vessel had passed 3 miles to the northward of Escribanos Bank.

“The captain thought the vessel struck upon a bank of coral. When she struck the second time the following bearings were taken: Quengo Island S.  $6^{\circ}$  E. (S.  $11^{\circ}$  E. mag.), and Tambor Island S.  $70^{\circ}$  W. (S.  $65^{\circ}$  W. mag.). No surroundings were taken. Vessels should pass well to the northward of this doubtful ground.

“**PIEDRAS AND PERRO CAYS.**—Off the northern part of San Blas Point, which is low and covered with mangroves, lie the Piedras and Perro cays, united to the Cay Frances Reef, which terminate at an island in front of a lagoon  $1\frac{1}{4}$  miles farther to the westward.

“**GULF OF SAN BLAS.**—San Blas Point, which forms the north point of the gulf of that name, is low and skirted by a reef to the distance of  $1\frac{1}{2}$  miles, on which are several cays;

the easternmost is named 'Cay Frances.' From San Blas Point to Mandinga Point, south of it, the gulf is 6 miles wide, and to the westward of that line it is about the same distance deep; the coast is low all round and bounded by mangroves. In a southwesterly and westerly direction from Cay Frances there are 12 or more islets, upon some of which are small fishing establishments, and to the eastward of them are many banks and islands, forming part of the Mulatas Archipelago, with various channels between.

The bottom is foul for  $1\frac{1}{2}$  miles northeastward of Cay Frances, at which distance the depth is 4 fathoms on the edge of the reef, whence it drops into deep water.

"SAN BLAS CHANNEL, the westernmost into the gulf, lies between the San Blas Cays to the westward and the Chichime and Lemon cays to the eastward and southeastward, and is  $1\frac{1}{4}$  miles wide, with depths in the fairway of 11 to 25 fathoms.

"CHICHIME CHANNEL lies close eastward of Lemon Cays, and is about one-half mile wide with a depth of 12 fathoms. Patches of 5 fathoms lie  $1\frac{1}{4}$  and 2 miles northwestward of Chichime Cays.

"HOLANDES CHANNEL, the largest of all in this direction, is  $2\frac{1}{4}$  miles in width, with depths of 13 to 30 fathoms on sandy bottom. Its entrance is formed on the east by the western extremity of the reef extending from the Holandes Cays, which break heavily, and on the southwest by Ieacos Cay, which is dry and covered with high icacos trees.

"At a little more than  $1\frac{1}{2}$  miles to the west-northwest of Holandes Cays there is a rocky bank of 6 fathoms, one-half mile long north and south, which breaks when there is but little swell. It should be left to the westward in entering.

"DIRECTIONS.—To enter the Gulf of San Blas by the San Blas Channel, which is the best, having opened out the mouth of the channel and being on the meridian of the second islet (from the westward) of the Lemon Cays, steer south (S.  $5^{\circ}$  E. mag.) toward it until about abreast Cay Frances, the easternmost of the San Blas Cays. Thence the course will be about southwest, through the middle of the San Blas Channel, between the reefs which extend from Cay Frances and those from Gallo Cay, the westernmost of the Lemon Cays. Being within the latter, a vessel may proceed as most convenient to an anchorage on the north side of the gulf, or to Inglesa Bay, in the southwest part of it, or to that in Mandinga Bay, which is well sheltered.

"Should the Holandes Channel be taken, the eastern side is well marked by the edges of the reefs extending from the westernmost of the Holandes Cays, and, as already said, a vessel should pass between them and the 6-fathom bank, on which the sea generally breaks, situated N. 62° W. (N. 67° W. mag.) 1½ miles from them. Then steer for the east end of the Icacos Reef, giving it a good berth in passing; and having brought Icacos Cay to bear N. 5° E. (North mag.) shape course to pass southward of Guard Cay to Mandinga Bay. The channel is clear of danger, with depths from 21 to 25 fathoms, oozy bottom, and from 2½ to 3 miles wide, between groups of rocks, detached cays, and reefs.

"CAUTION.—Little is known of the northwest or southwest heads of the gulf, and great caution should be exercised when navigating here; the eye, aloft, is the best guide.

"TRADE.—The district of San Blas has not been open to civilization or settlement, as the Indians inhabiting its coast and mountains are openly hostile to Colombian rule; it is therefore but little known. Vessels trading along this coast are obliged to call at Cartagena, where duties are levied and collected on their cargoes.

"MULATAS ARCHIPELAGO.—Off San Blas Point commences the extensive archipelago of the Mulatas, composed of cays, shoals, and reefs, which, sweeping round to the southeastward at a considerable distance from the mainland, terminate at Pajaros Island, about 80 miles distant. Pajaros Island lies about 2 miles northward of Pinos Isle. It is low, covered with brushwood, and surrounded by reefs having 7 and 8 fathoms close-to.

"The cays are mostly low, flat, sandy, and thickly wooded, and lying in clusters, having navigable channels between, leading into secure anchorages within them all along the shore. Some of the cays have springs of good water, and convenient spots for landing and careening, and the fishing and turtling around them is excellent.

"The main shore contains several sandy bays, with many small streams running into them, but from the fringe reef are extremely difficult of access.

"The interior of the main is high and mountainous, and there are many remarkable peaks, which serve as guides to the anchorages and channels to those with local knowledge.

"The principal channels are those of San Blas, Chichime,

Holandes, Caobos, Moron, Mangles, Puyadas, Arebalo, Playon Grande, Ratones, Rio de Monos, Cocos, Punta Brava, Zambogandi, Cuiti, Mosquitos, and Pinos, which are all more or less easily navigated by those acquainted with them. Great care and attention to the lead is required in navigating this coast, for it is supposed many banks lie outside the cays similar to those in the neighborhood of the Sasardi Islands, which in heavy weather are dangerous.

“**HOLANDES CAYS.**—This group is about 7 miles in extent east to west. Its eastern extremity lies N.  $84^{\circ}$  E. (N.  $79^{\circ}$  E. mag.), 18 miles from San Blas Point. The north side of the reef which bounds the cays is 8 to 10 miles from the coast, and the cays are separated from those immediately adjacent to the mainland by a clear opening 3 miles wide. A patch of 5 fathoms lies about 2 miles S.  $11^{\circ}$  E. (S.  $16^{\circ}$  E. mag.) of Caobos, the largest of the Holandes Cays. It is apparently the best channel to the anchorages in the Gulf of San Blas when coming from the eastward, but sailing vessels would have to leave by one of the northern channels. Many spots on the chart have not been sounded.

“**NAVAGANDI OR MONA RIVER.**—At 3 or 4 miles to the westward of Pinos Isle is the entrance to this little river. The water in it is excellent, but the narrow cuts leading in through the reefs are intricate and the breakers so heavy that it is extremely difficult and dangerous for a boat to get through them. Abreast the west end of Pinos Isle is the entrance of the Navagandi lagoon, which is blocked up by the reefs which skirt the shore all along.

“On a sandy spit on the east side there are a few huts, and 6 or 7 miles up the river there is a settlement where vegetables and poultry may be obtained.

“**PINOS ISLE**, the southeastern extremity of which lies northwestward, about 2 miles from Sasardi Point, is about a mile in length southeast and northwest, and a little less in breadth; it is separated from the main by a channel 400 yards wide in its narrowest part, with 2 to 3 fathoms water on sand and grass. The island is 400 feet high, and a hill extends through it, on which are two remarkable wooded peaks; its northeast and south sides are scarped and bordered by reefs, which, however, lie near the shore.

“**WATER.**—On the south side of Pinos Isle there is a small stream of good water, which runs down a gully and into a

small basin at the bottom of the declivity, but so near the shore that an unusual rise of the tide washes away the sand, and the sea flows into it.

"Firewood may be cut to the eastward of the watering place, but great care must be taken to avoid touching the manchineel tree, which abounds here and is poisonous.

"ANCHORAGE.—There is anchorage both off the east and west ends of Pinos Isle, but exposed, the former from the east to northeast, the latter from the north to northwest; and a constant ground swell rolls in, particularly at the eastern anchorage, which makes riding very uneasy. At the east end a berth will be found in 9 fathoms, with the south end of the island about N. 18° W. (N. 23° W. mag.), but vessels of light draft may go so far in as to bring it to bear N. 28° E. (N. 23° E. mag.). The point is so bold that a small vessel might heave down alongside it.

"The western anchorage is by far the better, being partly sheltered from the sea breeze. These anchorages, however, should only be used in case of necessity.

"SASARDI BAY AND HARBOR.—The Sasardi Islands are separated from Sasardi Point on the main by an opening three-fourths of a mile wide, which is exposed on the northeast side. From Sasardi Point the coast trends to the northward, then to the southwestward, forming a bay about three-fourths of a mile in extent, near the center of which there is convenient anchorage for watering in 4 to 6 fathoms. The Sasardi Rivulet, about 10 feet wide and with 2 feet of water on the bar, flows into the western side of this bay and is the best place to obtain water; canoes manage to get up it with some difficulty about 2 miles; on the north side of the entrance there is a village. The land is here much lower than in the neighborhood of Port Escoces.

"In the interior of the bay there are several shoals nearly awash and consequently easily avoided; a small reef with  $1\frac{1}{4}$  fathoms on it lies to the southward of Sasardi Point, distant about 800 yards, and just within the line of entrance about two-thirds the way across from Sasardi Point there is a hard flat ledge about 400 yards in length, upon which the sea generally breaks. The channel to the eastward of this ledge is only 400 yards wide, with a depth of 4 fathoms; to the westward of the ledge in mid-channel there are 9 fathoms. The outermost of the banks in the immediate vicinity of the

entrance has  $3\frac{1}{2}$  fathoms over it and lies N.  $42^{\circ}$  E. (N.  $37^{\circ}$  E. mag.) 2 miles from the western extremity of the Sasardi islands, with the northeastern extremity of Oro Island just shut in with the Crag Rock, bearing S.  $32^{\circ}$  E. (S.  $37^{\circ}$  E. mag.). A bank of  $4\frac{1}{2}$  fathoms lies N.  $5^{\circ}$  E. (north mag.)  $1\frac{1}{2}$  miles from the  $3\frac{1}{2}$ -fathom bank.

“SUPPLIES.—The inhabitants of the village of Sasardi subsist by fishing and hunting and the cultivation of plantains and cocoa. The latter article and cocoanut oil are exported in small quantities in American vessels, which give in exchange arms, ammunition, cotton, and culinary articles. No live stock is to be obtained, but the sea abounds in fish, and plenty of turtle are caught in May and June.

“The interior is densely wooded with trees of the most valuable description, growing to the height of 70 to 100 feet. Among them are found the mahogany, cedar, silk-cotton, ebony, satinwood, rosewood, fustic, logwood, with many of the pine family adapted for spars and masts. The Indians use cedar for their canoes and a red wood called calli-calli, which is very hard and durable, notwithstanding the destructive effects of the worms and insects of this climate.

“WATER.—The Sasardi Rivulet is by far the most convenient place at which to water.

“DIRECTIONS.—In approaching Sasardi Bay or Harbor from the eastward, the mark already given for the outer banks should not be crossed until the Sasardi village is brought just in sight to the southward of Sasardi Point, S.  $87^{\circ}$  W. (S.  $82^{\circ}$  W. mag.). This latter mark will lead to the southward of the outer bank, and when the west end of Sasardi Island bears S.  $23^{\circ}$  W. (S.  $18^{\circ}$  W. mag.) the course may be altered for either of the channels most convenient. If intending to enter the harbor between the cays and the main, and the eastern channel is taken, the reefs which skirt the Sasardi Islands should be rounded within 200 yards; if the western channel, the opening should be steered for about one-third the distance across the Sasardi Point.

“After passing the shoal in the middle, composed of hard limestone, Sasardi Island will be found steep-to, and anchorage may be taken up anywhere within 200 yards of it in from 5 to 7 fathoms. The shoals all lie on the western side of the harbor, and are easily avoided by the eye. To sail out is not so easy, except with a land wind, for the channels are narrow and the sea rough with the usual sea breeze.

"TIDES.—The tidal streams are overcome by a current which sets through the Sasardi Channel to the southeastward about one-third mile per hour.

"ORO ISLAND, the easternmost and highest of a range of cays and rocks which lie from 1 to 3 miles from the mainland and extend in a northwest direction about 5 miles, is 470 feet high at its eastern extremity. The edges of the reefs which skirt it and the little cays and rocks extending a mile to the southeastward of it to Piedra Isle always show themselves and are steep-to. The Oro Shoal of 4 fathoms, which lies 400 yards from the eastern point of that island, also breaks in strong breezes.

"CALEDONIA HARBOR.—Between these cays and the main are two well-sheltered harbors, the westernmost, Sasardi, the easternmost named Caledonia, which are only separated by a narrow bar with 12 feet water over it.

"The entrance to the harbor is one-half mile wide between the shoals fronting Oro Island and the Reventazones breakers, with a depth of 15 to 17 fathoms in the fairway and 8 to 9 fathoms in the anchorage. Apparently there is no settlement here.

"REVENTAZONES SHOALS.—The entrance to Caledonia Harbor is obstructed by three dangerous shoals, on which the sea breaks heavily in strong breezes, lying about a mile to the southeastward of the cays extending from the southwest end of Oro Island.

"The shallowest spots are known as Outer, Middle, and South shoals, with least known depths of  $2\frac{1}{2}$  to  $3\frac{1}{2}$  fathoms, and cover a space of  $1\frac{1}{4}$  miles north and south.

"A patch of  $4\frac{1}{2}$  fathoms lies about a mile N.  $72^{\circ}$  E. (N.  $67^{\circ}$  E. mag.) of the south extreme of south shore, about midway between it and an outlying 4-fathom patch in the approach to Port Escoces.

"Mount Vernon, on the southeast point of entrance to the harbor, and Piedra Isle, the southeasternmost of the cays (which is very small) in line, bearing about S.  $84^{\circ}$  W. (S.  $79^{\circ}$  W. mag.), will lead just clear to the northward of the outermost shoal, which has  $3\frac{1}{2}$  fathoms water. There are channels between the shoals and between the southernmost and the main, all of which are clearly pointed on the chart, but they are too intricate for a stranger to navigate.

"WINDS AND SEASONS.—In Caledonia Harbor, as elsewhere on this coast, there are two seasons, the wet and the

dry. The latter continues from January to April or May, when the wind blows strong and often violent during the day from north-northwest to north-northeast, accompanied by a very heavy sea, and lulls on the shore to nearly a calm during the night. At this season the temperature is about  $82^{\circ}$ , the atmosphere is exceedingly moist, and so hazy that at times the land can not be seen more than 5 miles, yet the climate is generally healthy.

"In the rainy season, which occupies the remaining portion of the year, the breeze lulls and becomes variable, and a land wind blows off, with occasional squalls from the southwest ward.

"TIDES.—It is high water, full and change, at Caledonia Harbor at 11h. 40m.; the rise at springs is  $1\frac{1}{2}$  feet and at neaps 6 inches.

"DIRECTIONS.—Approaching Caledonia Harbor, and having brought Oro Island to bear about S.  $51^{\circ}$  W. (S.  $46^{\circ}$  W. mag.) before Carreto Peak comes over the outer isleta (the line of the outer banks), Piedra Isle must be brought in line with a remarkable hill, bearing S.  $45^{\circ}$  W. (S.  $40^{\circ}$  W. mag.), which mark will lead between the outer banks. The reefs which skirt Ora Island must then be rounded at the distance of 400 yards, passing between them and the Reventazones Banks. From abreast Rocky Cay a vessel will generally have to work to windward, and when standing to the westward the south end of the sandy beach in Surf Bay must not be shut in with San Fulgencio Point, at the base of Mount Vernon, nor must Rocky Cay be shut in with Dobbin Cay when standing to the eastward.

"These limits give a clear space of 8 to 10 fathoms water on mud, in any part of which there is good anchorage. If desirable to go farther up, as far as Scorpion Cay, the eye must be the guide, observing that the bottom can not be seen at a greater depth than 12 feet.

"An entrance can also be made as far to the southward as to bring on the mark given before for clearing the north end of the Reventazones, but great care must be taken not to open Mount Vernon to the southward of Piedra Isle before these banks are passed or the Oro Rock is in line with Craig Rock, the outermost islet.

"In sailing out of the harbor vessels will generally have a wind either from the north-northeast in the season of the

breezes or off the land occasionally in the wet months. It will be merely necessary to skirt Rocky Cay and reef at a safe distance and, getting on the line of Piedra Isle and Mount Vernon, proceed to sea on that mark. Should the wind not admit of this, short tacks must be made toward and along the reef until past the outer Reventazones Shoal. In the event of missing stays when standing close to the Reventazones Breakers, a thing very likely to occur from the heavy sea, it would be better to keep away and pass to the leeward of the shoal than attempt to tack again. Vessels can also pass out along the shore to the southward of the Reventazones, taking care not to go outside the line between the west extreme of Dobbin Cay and a remarkable solitary tree on Scorpion Cay, N. 40° W. (N. 45° W. mag.), until the Aglatomate huts bear northward of N. 85° W. (West mag.), or the outer isleta is just shut in with the northern extremity of Escoces Point, when the vessel may haul out to the eastward of those shoals.

"Tree Top Hill, 200 feet high, touching north side of Mangrove Cay or the north extreme of San Fulgencio Point, bearing N. 65° W. (N. 70° W. mag.), leads between Escoces Point and the off-lying banks.

"ESCOCES POINT terminates at Pattersons Hill, 260 feet high; but 3½ miles to the southward of it the mountain ridge, which extends parallel to the shore, rises to the height of 1,180 feet, and about 7 miles to the westward to the height of 1,985 feet. About 3 miles southeastward of the point and about a mile from the shore are three small rocky islets, named Las Isletas, and within them is a cay of larger dimensions.

"PORT ESCOCES.—Escoces Point is the extremity of a narrow neck of land about 2 miles in length in a northwest direction which forms the northeast side of an inlet of irregular breadth, named 'Port Escoces.' In the center of the outer part there is a depth of 6 fathoms, whence it gradually decreases to 3 fathoms at the head of the inner arm.

The entrance is about three-fourths of a mile wide, but the outer part is obstructed by the Escoces Reef, 3 feet high, lying about three-fourths of a mile to the westward of Escoces Point; there is a channel for either side of it, but the western is the better. The west and south sides of the reef are bold, but about 400 yards N. 67° E. (N. 62° E. mag.) of it there is a small head, with 18 feet water. With a strong northeast

wind the sea breaks across between the rock and Escoces Point; also on the Middle Reef, Antonio and Harbor Rocks, in the interior of the inlet.

"In the approach from the southward and eastward are several coral banks. One of them, with a least known depth of  $4\frac{1}{2}$  fathoms, lies with the north extreme of Escoces Point S.  $81^{\circ}$  W. (S.  $76^{\circ}$  W. mag.), distant about 2 miles. A patch of 4 fathoms lies with the east extreme of the point South (S.  $5^{\circ}$  E. mag.), distant about  $1\frac{1}{2}$  miles.

"Carreto Peak, in line or shut in on the outer islet, leads inside the  $4\frac{1}{2}$ -fathom bank, and the peak kept open of that islet leads outside the 4-fathom bank.

"WATER.—Several small rivulets of good water run into the south side of the port, but they are sometimes dry, and landing is generally difficult. In a little sandy bay about 3 miles to the westward of Escoces Point, is the entrance of the Aglatomate River; and one-half mile farther on, in Surf Bay, is the entrance of the Aglaseniqua.

"These rivers are from 20 to 30 feet broad and never dry, and the waters in both are excellent, but difficult to obtain in rough weather. When moderate, the best landing is under cover of the little reef at the mouth of the Aglaseniqua; but the most convenient place for watering is at the mouth of the Sasardi, farther northward. On the west side of the entrance of the Aglatomate there are a few bamboo huts.

"DIRECTIONS.—Vessels of heavier draft than 20 feet must approach the entrance to Port Escoces with great care, for there are several coral banks in the offing which, in heavy weather, are dangerous. Having rounded the Escoces Reef within the distance of about 400 yards to the westward, the eye must be the guide, directing the course in mid-channel until nearly abreast the narrowest part of the entrance, between the old fort point and the opposite side, when the eastern shore should be kept aboard to avoid the Middle Reef, which may be seen from aloft.

"Anchorage may be obtained as soon as convenient within the Middle Reef. In entering the inner arm the wind baffles so much after passing Harbor Rock as to make it very dangerous, although there may be a strong breeze outside.

"PORT CARRETO.—On the west side of Carreto Point, between it and some small islets lying about  $1\frac{1}{2}$  miles to the northwestward of it, the shore curves to the southwestward,

forming a bay about a mile deep, in which there are not less than 3 nor more than 8 fathoms water. Being exposed, however, to the heavy sea thrown in by the northeast breezes, it is only of use as an anchorage in the season of light weather.

“CARRETO SHOALS.—To the northward of this port about  $1\frac{1}{2}$  miles are two small rocky banks, near each other, lying in a northeast and southwest direction, with  $5\frac{1}{2}$  fathoms over them and 20 to 25 fathoms close around, but they break with fresh breezes.

“ANACHUCUNA BAY.—From the point under the peak of Carreto to Cape Tiburon the shore, consisting of a sandy beach, extends about east-southeast 13 miles, forming a bend about  $2\frac{1}{2}$  miles deep, named Anachucuna Bay.

“PORT ESCONDIDO.—At the northwest end of this bay, about 2 miles to the south of Carreto Point, is the little harbor of Escondido, adapted only for coasting vessels.

“CAPE TIBURON.—The northwestern extremity of the Gulf of Darien is rocky, high, and scarped; projecting boldly out to the northeast, it forms on each side a small harbor. That to the southward of the neck is so narrow as to be of little use, but Miel Harbor, on the west side, has good holding ground of sand and clay, in 11 to 12 fathoms water.

“GULF OF DARIEN.—The entrance to this gulf is formed between Cape Tiburon and Caribana Point, which are 29 miles apart; and from this line the gulf is 46 miles long.

“THE WESTERN SHORE.—From Cape Tiburon the coast takes a southeasterly direction for about 12 miles to the Gandi River; midway between, a mile offshore, lies Tonel Island, which is steep-to on its east side.

“From Gandi River to the point of that name the shore trends about southeast about  $1\frac{1}{2}$  miles, forming Estola Bay, into which the little Estola River empties, but neither the river nor the bay is of any importance.

“From Gandi to Tripo Gandi Point a low sandy shore trends nearly east-southeast about 6 miles, forming Gandi Bay. Piton Islet, steep-to, lies one-half mile from the coast. At 3 miles S.  $56^{\circ}$  E. (S.  $61^{\circ}$  E. mag.) are the Bolanderos Islets, which consist of one large islet, with several small ones to the southward of it, all of them clear and bold and not farther than three-fourths mile from the shore. Tambor Islet lies 3 miles to the southward and eastward and rather more than one-half mile from the shore; at about one-half N.  $28^{\circ}$  E. (N.

23° E. mag.) of it a rocky shoal shows itself, between which and the islet there is a clear passage; it is, however, always better to pass outside. To the westward of Tambor Islet the shore forms a bay named Port Escondido, which affords shelter for small vessels. The Tumate islets, three in number, one-half mile from the coast, are 4 miles farther on. Four miles from the Tumate Islets are the Tarena Cays, which lie close to the shore.

"The whole of the coast between the Tarena Cays and Cape Tiburon is high, bold, and clear of danger, but it is very wild in the season of the breezes. At this period the eastern shore of the gulf should be kept aboard, where good anchorage will be found, if necessary, and a smooth sea for working to windward.

"At 2½ miles southeastward of the Tarena Cays the shore takes an easterly direction for 6 miles to Revesa Point, forming the northern boundary of the delta of the Atrato. The principal mouth of the river opens out about 3 miles to the westward of the point; but being so exposed to the breezes, the commerce is more conveniently carried on by means of the little Faisan Branch, which has the advantage of the adjacent anchorage in Candelaria Bay.

"The sand thrown out of the main branch is deposited at a long distance, and this part of the coast should not be approached nearer than 2 miles.

"In the bight, at 5 miles west of Revesa Point, a hill named the Peak of Tarena rises near the shore, and thence a lofty ridge, having several remarkable peaks, stretches in a north-west direction as far as Cape Tiburon; the southernmost is named Candelaria, the center one Gandi, and the northernmost Pico de Cabo. The latter rises beyond Cape Tiburon.

"The western shore of the gulf, for the distance of about 20 miles from its head, is low, swampy, and irregular, being formed by the delta of the Atrato River, which enters the gulf by numerous branches, eight of which are navigable for canoes and bungs. At the outermost part of the delta the gulf is contracted to a width of only 4 miles.

"ATRATO RIVER, probably the fourth largest river in volume in South America, rises in a spur of the Antioquian Range that connects the latter with the divide or Cordilleras of Darien. Flowing on a course generally north for several hundred miles, it empties through thirteen mouths into the

Gulf of Darien. It has numerous tributaries on both sides. This river was surveyed by Commander Lull, U. S. Navy., for 160 miles, or as far up as the mouth of the Bojaya. Its banks are low, and for the whole of this distance, during the wet season, are overflowed to a depth of 3 or 4 feet, from which cause all the houses are built upon piles. Below Sucio there are no inhabitants upon the banks, as they are submerged ten months of the year. This river resembles the lower Mississippi in grandeur of proportion, with its long reaches, its width varying from 500 to 825 yards, and its great depth, often exceeding 10 fathoms. Its current varies from 2 to 3 knots per hour, which would be much increased in the rainy season but for the overflow of the banks, which permits an escape of the surplus water by spreading for miles over the adjacent country.

"The survey was made in a rowboat floating down with the current, and nowhere in the channel were found less than 28 feet. Over the whole distance surveyed no rocks were found; the bottom was muddy, and the river unobstructed by snags. So well defined is its channel and so free from obstructions that a single passage up and return would be sufficient to make one acquainted with the navigation.

"The mouths of the Atrato are obstructed by bars, upon which there will not be found more than 6 feet of water. They differ in character, however, according to their protection from the sea. The Uraba mouth, being farthest from the sea, and also protected by a long sand spit, is fixed in its nature, and the bar is of hard sand. These bars, as they increase by fresh deposits, extend out and break off abruptly from 2 to 10 fathoms.

"The extensive delta projects far beyond the limits of the mainland, and banks, composed of a deposit of the softest ooze, extend about a mile outside the bars, exposed, however, to constant changes, especially during the season of the breezes.

"REVERSA BAY.—From Revesa or Choco Point to the northwest point of Candelaria Bay the low mangrove shore trends about south by east 5 miles. Revesa Point, projecting a little to the eastward, affords off its south side good anchorage with northerly winds. Vessels entering the Revesa anchorage may pass within 300 yards of that point, and anchor as soon as it bears eastward of north in 13 or 14 fathoms.

The sand bank skirting Candelaria Bay gradually disappears as Revesa Point is approached.

“CANDELARIA BAY.—On the north side of the delta of the Atrato there is a bight about  $2\frac{1}{2}$  miles in extent, named Candelaria Bay. The land around, however, is so low that the greater part is inundated, even at low water; and it is bordered with mangroves, reeds, and rushes, so that only the northwest part of the bay appears dry. A sand bank skirts the whole circuit of the bay and extends a mile southeastward from the northwest point, which reduces the entrance between it and the mouth of the Little Faisan branch of the Atrato to scarcely a mile in breadth. Off the mouth of the Faisan, and along the southeast side of the bay, however, the bank does not reach to more than about 300 yards from the shore, leaving a space of good anchorage about  $1\frac{1}{2}$  miles in extent.

“The bar of the Little Faisan has 3 feet of water upon it, and it is one of the best branches by which canoes enter the Atrato.

“DIRECTIONS.—To enter Candelaria Bay great attention is required to the soundings, care being taken not to shoal in less than 17 fathoms in the entrance nor 12 within. This caution is absolutely necessary, for the sand bank that skirts the shore is so steep that it shoals suddenly from 13 to 5 fathoms, and from 5 to getting aground. By preserving a proper depth a vessel will pass about 800 yards off the southeast point, and, having entered, the discolored water on the edge of the bank may be seen from aloft.

“TIDES.—The tide in the Gulf of Darien rises 2 feet.

“THE EASTERN SHORE.—From the head of the Gulf to Uraba Point the eastern shore trends nearly north 29 miles, and is very low and swampy, the only remarkable object being the little hill that forms Cayman Point 9 miles from Uraba Point. The soundings are regular, and this shore may be easily navigated with proper attention to the lead. The head of the Gulf is about 10 miles in breadth, and the Suriquilla River flows into the middle of it.

“From Uraba Point the shore, which is low, with a few small hillocks, trends about north-northwest for 6 miles to the Salado River, and thence for about  $5\frac{1}{2}$  miles in a westerly direction to Arenas Point, a low, sandy peninsula, bold and steep-to.

"From Arenas Point the shore trends to the northward for about 3 miles, when it bends abruptly to the northeastward to Caribana Point, the north point of the low, sandy peninsula, about  $2\frac{1}{2}$  miles in breadth at the extremity from north to south. The west face of this peninsula is bold and steep-to, and may be safely coasted at the distance of a mile. The interior is occupied by the Aguila Lagoon, about  $5\frac{1}{2}$  miles in extent from east to west, in which are many mangrove cays.

"CARIBANA POINT is low and wooded. At a short distance within the point is Cerro Aguila, and, although of only moderate height, it is remarkable from standing alone in the middle of low land, and is a useful guide."—*Hydrographic Office, Gulf of Mexico and Caribbean Sea, No. 64.*

#### DESCRIPTION OF THE PACIFIC COAST.

"COAST.—Between Burica Point and the southwest extremity of Parida Island, 32 miles N.  $85^{\circ}$  E. of the point, the coast recedes 17 miles in a gradual curve, forming a large bay, within which are no known dangers. On the northern shore, which is low and wooded, are the small rivers Bartolome, Pinos, an Piedra, but no port or place of resort. The western shore is higher and deep water approaches nearer to it. The open anchorage along the coast is considered in general safe.

"The delta of the David River lies on the eastern side of the bay north of Parida Island and is formed by numerous low islands fronting the coast for a distance of 17 miles, from the Boca San Pedro on the west to Boca Chica on the east, covered by extensive shoals with heavy breakers. Within the islands the low coast is a labyrinth of small streams and osteros.

"BOCA SAN PEDRO, about 30 miles N.  $60^{\circ}$  E. from Burica Point, between the large islands San Pedro and Sevilla, is the westernmost and main entrance to the David River and the shortest approach to the city of that name. The original surveyors, both British and French, regarded this entrance as impracticable for vessels and even for boats, although used by the native fishermen, and considered the Boca Chica, with the connecting 25 miles of intricate navigation, the only practicable approach to the river and city of David.

"A sketch survey made in 1900 by Mr. J. A. Rupert Jones, of the Pacific Steam Navigation Company, and now incorporated on the latest charts of the locality, shows a close line of

soundings across the bar in a comparatively straight course, with a least depth of 4 fathoms, to an anchorage in  $4\frac{1}{2}$  fathoms about three-fourths mile northward of San Pedro Point, the southeast end of San Pedro Island. The channel is dangerous with a heavy southwest swell, and the banks bordering the channel on the eastern side within the bar and opposite San Pedro Island are extending westward; the present width of the channel abreast of San Pedro Point, which it closely skirts, is about 700 yards, the width of the opening between San Pedro Point and Powis Point, the western extremity of Sevilla Island, being nearly  $2\frac{1}{2}$  miles. On San Pedro bank, which forms the west side of the channel, the sea breaks heavily, and along the edge of the bank incessantly.

"The German bark *Theodore*, of 680 tons, registered, crossed the bar of the Boca San Pedro February 2, 1892, and lay at the anchorage above San Pedro Point until March 24, when, having loaded a cargo of brazil wood, she passed out, drawing 15 feet, being the first large vessel to visit the port. Captain Saunders of the steamer *Elvira*, of 200 tons, on whose recommendation the *Theodore* was chartered and who towed the vessel into and out of the harbor, appears to have been the first to discover a navigable channel across the bar and the first to make general use of it. At the time of the *Theodore's* visit the coasting steamers calling at David, although with Punta Arenas as a farther destination, made the long circuit by the Boca Chica.

"ANCHORAGE.—There is good anchorage off the entrance to the channel in 13 fathoms with the southeast end of San Pedro Island bearing N.  $29^{\circ}$  E. (N.  $23^{\circ}$  E. mag.) and distant  $3\frac{1}{2}$  miles. The water shoals gradually shoreward, and a mile farther in on this bearing there are 8 fathoms. From the anchorage here given, to enter the port the course is first N.  $12^{\circ}$  E. (N.  $6^{\circ}$  E. mag.) for  $1\frac{1}{2}$  miles, then N.  $57^{\circ}$  E. (N.  $51^{\circ}$  E. mag.)  $1\frac{1}{2}$  miles, then N.  $17^{\circ}$  E. (N.  $11^{\circ}$  E. mag.)  $1\frac{1}{2}$  miles to the inner anchorage, the last course for half the distance skirting the east side of San Pedro Island at about 200 yards.

"CAUTION.—On account of the liability to frequent and sudden changes of all open sea bars, it would manifestly be imprudent to use this channel without a pilot or prior investigation by boat.

"CIUDAD DE DAVID, the capital of the province of Chiriqui, with 9,000 to 10,000 inhabitants, lies about 10 miles north of

San Pedro Island and the river mouth and about  $2\frac{1}{2}$  miles from Pedregal, a small village on the right bank of the western branch of the river. From the anchorage within San Pedro Point a least depth of three-fourths fathom can be carried  $10\frac{1}{2}$  miles to Pedregal and a couple of miles beyond, the small coasting steamers of 200 tons ascending to the village, whence a road leads across a treeless grassy plain to the city. This plain gives good pasturage to many horses and cows. On nearing the city the character of the country changes and hills occur; the ground is more or less cultivated and is divided up by fences. Nothing, however, appears of the town until the first houses are reached. It does not present a striking appearance, consisting for the most part of bamboo huts and wooden houses with thatched roofs and clay floors. Nevertheless, there are many well furnished stores in which can be bought at a reasonable price all that one may wish. There were at the time of the *Theodore's* visit but few foreigners settled in David, among them being a German physician, here stranded, and a few Italian laborers.

"SUPPLIES.—Meat, poultry, eggs, rice, yams, and fruit are abundant and cheap. The price of a live ox is \$12 to \$14. Only flour is dear. Good drinking water can be obtained from the river at the junction of the eastern and the western branch, above the Hacienda Pino.

"Sevilla and San Pedro islands abound in game, which is easily obtainable. The latter island is a private possession and consists of open grass fields and dark forests, giving support to some hundreds of cattle and numerous horses and swine. Of human dwellers there are here only the so-called matador, who has the supervision of the cattle, and a few nomadic Indian fisher people. The soil, though fruitful, is not cultivated.

"CLIMATE.—The climate, in the dry season at least, was considered by the captain of the *Theodore* to be not unhealthy. During the seven weeks of the *Theodore's* stay at San Pedro, February 2 to March 25, there was not a single case of sickness on board, although the days were hot and all the work of discharging ballast and taking in and stowing the cargo of brazil wood was done by the men. The nights were always agreeably cool and there were no mosquitoes.

"PARIDA ISLAND is of irregular shape, about 4 miles long

NNE. and SSW., and 2 miles wide in its widest part. It is well wooded, but not high, and has rivulets affording abundance of water. Numerous islets with many sunken reefs among them lie off the east and southeast sides of the island to a distance of 5 miles, all of them being apparently within the line of 10 or 12 fathoms. Bolano and Baraco, the largest of these islets, terminate the group, lying about  $4\frac{1}{2}$  miles east of the south end of Parida. The chart shows at 2 miles eastward of them several rocks awash, and at about three-fourths mile southward of Baraco several rocks under water. Close to both groups are soundings of 12 fathoms. Channels doubtless exist among the islets and reefs, but vessels must keep outside of them, as they have not been closely examined, and in approaching David Bay from the southwestward give the whole locality a good berth.

“PARIDA ANCHORAGE.—The only anchorage is at the northeast end of the island, in  $6\frac{1}{2}$  fathoms, sheltered from the southward by the long, low island Gami. Here there is a sandy beach for landing and abundance of good water. To reach this anchorage from the eastward from a position west of Widow Rock steer for the San José islands, and then, leaving these islands to the northward, steer for the north end of Parida, maintaining a depth of 7 to 6 fathoms, but decreasing to  $3\frac{1}{2}$  fathoms as the anchorage is approached, when it deepens again to  $6\frac{1}{2}$  fathoms at the anchorage, close to the shore.

“A narrow channel with 8 to  $3\frac{1}{2}$  fathoms of water leads seaward close around the north end of the island.

“BOCA BRAVA, between Sevilla and Brava islands, lies  $5\frac{1}{2}$  miles north of the north end of Parida, from which a channel leads through the shoals in almost a straight course with a least depth of 3 fathoms, deepening between the islands to 6 fathoms, and within to 9 fathoms. There is no information as to this channel being used to reach an anchorage within the islands or to communicate with David, although as the entrance is exactly marked by the north point of Parida and the channel more sheltered than that of San Pedro and deeper than the Boca Chica it would appear to have at times decided advantages.

“CHIMMO BAY, at the southwest end of Parida Island, is small, with depths of 10 to  $2\frac{1}{2}$  fathoms. The Santa Cruz Islet fronts the bay, and the passage in is north of the islet, some

rocks extending southward from it to the shore. A reef also runs southward a short distance from some islets on the north side of the bay. Good fresh water may be obtained in the northeast part of the bay.

"TIDES.—High water, full and change, in Chimmo Bay is at 3h. 15m.; rise of tide,  $10\frac{1}{2}$  feet.

"CAUTION.—The southwest point of Parida Island should be given a berth of about a mile on account of some sunken rocks one-half mile from it, with depths of 15 and 16 fathoms close to them.

"GRONO ROCK, with a depth of 6 feet over it and 30 fathoms close to, has been reported to exist  $3\frac{1}{2}$  miles S.  $37^{\circ}$  W. (S.  $31^{\circ}$  W. mag.) from Santa Cruz Point. Breakers were seen in this locality by the master of the steamship *Casma*, who was informed by a diver engaged in the pearl fishery of the existence of the rock, with particulars as above. It has been entered on the chart as doubtful in position.

"DAVID BAY, as named by the original surveyors, lies between Parida Island and El Juco Point, 11 miles N.  $67^{\circ}$  E. of the SE. part of the island, the name being also given on the present chart to the great bay west of the island. In it are numerous islands and rocks, but with the assistance of the chart little difficulty should be experienced in selecting an anchorage.

"THE MONITAS are two islets on a reef lying about a mile nearly south of Juco Point. The western islet closely resembles a saddle. The channel between the Monitas and Juco Point is considered unsafe on account of the currents in it, although the depth is from 7 to 8 fathoms; hence vessels making for Palenque anchorage generally pass to the southward of these islands.

"VIUDA OR WIDOW ROCK, lying  $2\frac{3}{4}$  miles S.  $11^{\circ}$  E. of the western Monita, is an isolated rock with a reef extending from it one-half mile in a direction S.  $69^{\circ}$  E. At low water four pinnacles are uncovered, but at high water only one is visible. As this rock and reef are both steep, with soundings close around them of 10 to 12 fathoms, great care is required in avoiding them. It is said that to vessels approaching David Bay from the southward the position of the Viuda may generally be known by breakers, but whether this be the case or not, lying in the fair way of vessels and so far from the shore, it is a very formidable danger.

"A sunken rock, the existence of which there is great reason to doubt, was many years ago reported at about 4 miles SSE. mag. from the Viuda. The French surveying vessel *Obligado* searched for it unsuccessfully, although assisted in the search by a native who stated that he had seen breakers upon it; it was said to show but very rarely. The difficulty of finding an isolated sunken rock in deep water is well known; hence it will be prudent to exercise more than ordinary vigilance when in the vicinity of this reported danger, especially as no soundings are recorded about the site.

"EL BUEY, a dangerous rock of small extent in the middle of David Bay, with soundings of 5 to 7 fathoms close to it, only uncovers at half tide, not showing at all in fine weather at high tide. No well-defined landmarks can be given for this danger, but it lies  $1\frac{1}{2}$  miles N.  $49^{\circ}$  E. from the summit of the highest San José islet and 3 miles N.  $78^{\circ}$  W. from the western Monita. The chart shows the rock to be on the range of the southeast extremity of the San Jose group, the southernmost of the Linartes, and the NW. tangent of Bolano.

"SAN JOSÉ islets are a group of four wooded islets united by a reef. They are safe of approach except that the reef projects from them one-fourth mile to the eastward, and a 2-fathom spot lies three-fourths mile to the westward. Midway between San José and Bolano islands is a cluster of islands named Linartes.

"PALENQUE ISLAND, of irregular shape, 256 feet high and about  $1\frac{1}{2}$  miles in extent, lies on the south side of Brava; Deer Islet, on which was the observation spot of the survey, lies off the southeast point of Palenque. The shoal water which limits the bay trends about NE. by N. and SW. by W. from Deer Islet.

"PLAYA GRANDE BAY, lying north of Juco Point and the chain of islands extending from the point to the Boca Chica, has many sunken reefs in it and has not been closely examined. The passage south of Carre Island into the bay, nearly a mile wide, has 6 fathoms of water, and this depth is carried about three-fourths mile inside, gradually decreasing to 3 fathoms at about 700 yards from the eastern end of the bay, where there is excellent shelter for a small vessel. Chuchegal Bay opens from the northeastern part of Playa Grande and extends about  $1\frac{1}{2}$  miles northeastward, to the base of Red Hill, but has not been sounded out or closely examined. The

country behind the bay affords abundant pasturage for large herds of cattle.

"BOCA CHICA,  $3\frac{1}{2}$  miles N.  $65^{\circ}$  W. of Juco Point, the narrow channel between Ventana and Saino islands leading into the David River, is practicable for only light-draft vessels, there being in some parts of it at low tide only 8 to 10 feet of water. Boca Chica may be recognized by the rocks of Ventana Island, which have been pierced by the sea. Lavandera Rock, an isolated danger, covered at high water, lying on the east side of the entrance 300 yards southward of Saino, must be carefully guarded against, there being a depth of 5 fathoms close to it on the south side. Within the entrance, at the east end of Brava Island, the channel expands and forms an anchorage called El Pozo (the well) with a depth of 6 fathoms. The village of San Lorenzo is partly in sight at the western end, consisting of about a score of huts in the midst of orange and banana trees.

"ANCHORAGE.—During the fine season there is good anchorage off the Boca Chica in 5 fathoms, sheltered from the northerly winds which have then considerable strength. When the southwest winds prevail it is better to anchor farther out under shelter of the San José islets.

"A more open anchorage, suitable for large vessels, is in 8 fathoms midway between San José islets and the Monitas.

"TIDES.—High water, full and change, at Palenque and Parida anchorages is at 3h. 15m.; springs rise  $10\frac{1}{2}$  feet, neaps 8 feet. During the *Obligado's* visit the flood stream at the anchorage outside the Boca Chica was observed to set NNW., and the ebb in the opposite direction, with an average strength of 1 mile an hour, diminishing in force toward the San José and Monitas islands. Within the entrance and in the river the current was much stronger.

"SUPPLIES.—At the village of Boca Chica or Puerto San Lorenzo, on the north side of the river and  $3\frac{1}{2}$  miles from the sea, cattle, poultry, eggs, fruit, and vegetables can be procured. Water of good quality can be got from the stream immediately east of the village.

"DIRECTIONS.—Vessels from the westward or southward should pass between the Viuda and the rocks east of Bolano, and if from the eastward, between the Viuda and the Monitas, in either case steering for the San José islets on a safe bearing until well past Viuda. If intending to anchor off

Boca Chica, when west of Viuda steer for Carré Islet, and when one-half mile from its south point continue along the south side of the chain of islets to the anchorage.

"THE LADRONES are two rocky, barren islets of moderate height, and together not more than a mile in extent, lying 14 miles S. 20° W. (S. 14° W. mag.) of the southwest point of Parida. They are very steep-to, with 70 fathoms close to their southern edge. The only known dangers are some rocks extending from them to the northward about 2 miles, and a very dangerous reef at 4 miles in the same direction with only 6 feet of water over it at low tide. As this reef is only shown by breakers when there is a stiff breeze, it must be carefully guarded against.

"MONTUOSA ISLET,<sup>a</sup> lying 27 miles S. 25° E. (S. 31° E. mag.) from the Ladrones and 22 miles west of Coiba Island, the nearest land, rises to a height of 500 feet and has its summit covered with cocoa and other trees. A narrow reef, partly above water, extends from it about 3 miles in a westerly direction, and a reef also runs off from its southeast side. Captain Colnett landed here in 1794 and obtained a quantity of cocoanuts and a few birds. He mentions that the bottom on the south side of the island and also the shore near the sea is rocky. A sandy beach was found behind some little creeks that run in between the rocks, which afforded a safe landing place for boats. There was a great plenty of parrots, doves, and iguanas, and probably other refreshment.

"SECAS ISLANDS are a group consisting of three principal islands and numerous islets and rocks, covering an extent of 5½ miles in latitude by 3 miles in longitude, and lying about 15 miles from the coast between David Bay and Port Nuevo. About and among them are no known sunken rocks the positions of which are not usually indicated by breakers. Small vessels may find good shelter here, and on some of the islands a landing may be effected; but no fresh water can be obtained. The best anchorage is stated to be in 10 to 12 fathoms, on sand.

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<sup>a</sup>The center of Montuosa Islet, as cut in February 5, 1902, by the U. S. S. *Concord* from numerous positions of the ship obtained each time by not less than three cross bearings of Jicarita, Quibo, and the Ladrones Islands was found to be about 2½ miles N. 44° E. (N. 38° E. mag.) of the charted position, approximately in latitude 7° 29' N., longitude 82° 18' 30" W.

"LA BRUJA ROCK, about 3 miles east of the north end of the largest island, is a formidable danger, especially at night. It is stated by some authorities to be almost awash at low water and by others to be awash at high water, and is surrounded by depths of 20 to 24 fathoms.

"CONTRERAS ISLANDS, a group about 14 miles southeastward of the Secas and  $9\frac{1}{2}$  miles north of Coiba, composed of two principal islands with many small islets and rocks, are uninhabited and have no good anchorage. Vessels may approach these islands without hesitation if due precaution be taken, as the depths near them are from 30 to 40 fathoms and it is believed that there are no sunken dangers among them that are not marked by breakers.

"PROSPER ROCK, so named from the wreck of *Le Prospère*, a French ship that was drifted onto it in a calm, lies about  $1\frac{1}{2}$  miles south of the southern island and has the appearance of a black tower. A reef which uncovers at low water of spring tides extends from it about 200 yards in a south-westerly direction. It is not safe to pass between Prosper Rock and the islands on account of a reef midway in the channel, which is partly dry at low water.

"COAST.—At  $1\frac{1}{2}$  miles east of Juco Point the coast turns northward for  $3\frac{1}{2}$  miles to the mouth of San Lorenzo River, and thence trends S.  $77^{\circ}$  E. for 20 miles to Espartal Island, at the mouth of the river of Pueblo Nuevo. Nearly all this shore is low and fronted by a sandy strand; the entrances of the various rivers are barred and can usually be recognized by the white trunks of the mangrove trees, the tops only being in leaf. About a dozen miles inland is a range of hills between which and the sea is a wooded plain.

"There are no known sunken dangers along this coast, and vessels may skirt it at a distance of 2 to 3 miles in soundings of 6 to 11 fathoms. Some cliffs of red color eastward of San Lorenzo River and ending at about 13 miles from Pueblo Nuevo are very conspicuous.

"VENADO ISLANDS, on the east side of Juco Point, consisting of one large island near the point and three small ones on a bank about a mile to the eastward, are said to be a good mark for vessels approaching from the eastward.

"SAN LORENZO BAY, formed by the bend in the coast east of Juco Point, is so thickly strewn with rocks that all vessels should avoid entering it, and for the same reason the river

can be approached only in boats. A considerable village lies on the San Lorenzo River, a few miles from the sea.

"PORT NUEVO lies just within the southern mouth of the Pueblo Nuevo River, now charted as Rio San Lucia, or Remedios. The entrance, which is south of Silva and Insolita islands, from whatever direction approached may be at once recognized by the peculiar formation of the Cayado Hills, which rise to heights of 300 and 400 feet from the narrow peninsula forming the south side of the port, and from a distance appear as two islets. Sugarloaf Hill, 540 feet high, standing close to the shore near Espartal Island, is a good mark for the port, as are also the two wooded islets, Silva de Tierra and Silva de Afuera, distant, respectively,  $1\frac{1}{4}$  and  $4\frac{1}{4}$  miles westward from Entrada Point.

"Espartal and Insolita, two large marshy mangrove islands made of the soil brought down by the floods, front the coast for a distance of 7 miles, forming the river delta. The Boca de Santiago, between the two islands, although the direct entrance to the river, is navigable only by boats and at high tide, being obstructed by shoals through which, in 1899, there was no channel; the narrow passage north of Espartal is also unnavigable.

"From Aguda Point, the south end of Insolita, the Belitre Bank, partially dry at low water, extends  $1\frac{1}{4}$  miles westward along the north side of the channel, ending opposite Entrada Point, and forms a natural breakwater for the port. The rocky islet Intrusa, steep and safe of approach on all sides, lies nearly in mid-channel between Aguda Point and the south shore. Robalo Island, three-fourths mile northeastward of Aguda Point, is about three-eighths mile in extent, with a channel on either side, a mud bank extending from it about the same distance to the southward. Numerous rocks are reported in the eastern channel, that on the Insolita side, though narrower, being the one recommended for use.

"Opposite the north end of Robalo is Dedo Point, from which the three remarkable Dedo (finger) hills, about 1,500 feet high, extend in a northeasterly direction, the line of the hills passing through Entrada Point. Herron Islet lies on the east bank of the river, opposite the south end of Robalo and three-eighths mile above La Tinta Cove. The south and east shores of the port are bordered by shoal water to a distance of one-fourth mile. Point Arenitas is at the

north end of Insolita, and  $1\frac{1}{2}$  miles above is Rocky Point, which marks the real mouth of the river. Just within the rivers Jacobo and Santiago enter the San Lucia from the eastward.

"The bay is inhabited by a few Indians in ranchos or huts scattered along the beach, and there are said to be a number of small villages on the numerous streams that fall into the river, but by far the largest is that which gives to the river its name. San Juan Enfrente, a cattle corral and clearing, is on the right bank of the San Lucia,  $2\frac{1}{2}$  miles above Rocky Point.

"Some eggs, fowl, vegetables, and fruit may be obtained. Belcher states that water can not be procured in any quantity, but Captain de Rosencot, of the *Obligado*, says that good water may be procured from a brook which falls into the small bay on the east side of Cape Cayado (Entrada Point).

"THE CHANNEL, according to the survey of 1854, supplemented by an examination in 1900 by Mr. J. A. Rupert Jones, of the Pacific Steam Navigation Company, carries a low-water depth of 6 to 8 fathoms as far as Intrusa Islet, the width north of Entrada Point being about 400 yards and increasing within to about 750 yards near the islet. Farther in the depth is quite irregular, but 4 fathoms at low water may be carried more than a mile, probably 3 fathoms to Rocky Point, north of Insolita, and 1 fathom a considerable distance farther up the San Lucia.

"The anchorage selected by the French surveying vessel *Obligado* in 1854 was immediately southward of Intrusa, with the islet in range with the south end of Insolita. Eastward of this the channel expands considerably, but there are several isolated shoal spots,  $2\frac{1}{2}$  and 3 fathoms, restricting the anchorage space and making it inconvenient for large vessels. To a draft of less than 16 feet it offers the advantage of ample space, with protection from all winds. A few small buoys to mark the shoal spots and the ends of the shoals would greatly increase its usefulness for large vessels. Excellent ranges are afforded by Intrusa Islet with Entrada Point and the two Silvas.

"Westerly winds, frequent from June to October, are said by the inhabitants to send occasionally into the river a very heavy sea, which causes considerable inconvenience to vessels anchored near Intrusa. At such times it will be advisable to run to the inner anchorage.

"TIDES.—High water, full and change, at Port Nuevo is at 3 h. 44 m., rise of tide about 10 feet; at San Juan Enfrente at 4 h. 30 m.; rise 12 to 16 feet.

"PUEBLO NUEVO VILLAGE, now Los Remedios, is said to be at some distance within the river, north of Insolita Island, and the passage up to it so intricate that it can only be found by native guidance. Provisions are said to be obtainable here in considerable quantities. The principal article of trade is the sarsaparilla, that of this neighborhood being esteemed of a superior quality. A venomous species of serpent, the bite of which is fatal, is numerous on the mainland and on the islands.

"DIRECTIONS.—To carry 6 fathoms, the best water, into the port the entrance should be approached on a north course, keeping from one-fourth to one-half mile from the shore just below Entrada Point, in order to avoid the shoal water westward of the point and the bank with 4 to 5 fathoms extending southeastward from Silva de Tierra. When Intrusa Islet opens from the point, steer for the islet, passing close to the point, and when within steer to pass southward of Intrusa to the inner anchorage, or anchor in 9 fathoms, fine sandy bottom, on the range of Intrusa and Aguda Point. Entrada Point, in line with the north end of Silva de Afuera, leads through the narrowest part of the channel between Belitre Bank and the shoal water to the southward.

"From Aguda Point about a mid-channel course leads up the river as far as Rocky Point, above which the channel passes between wide shoal banks on either hand and ascends the western stream.

"The best time to enter the river is with the flood stream and the wind from seaward; and to leave the river, with the land wind and a little before the end of the flood. Vessels must pass south of Silva de Tierra, but may pass between the two Silvas, the depth here being from 8 to 12 fathoms. By entering at the first of the flood the edges of the banks are plainly seen.

"COAST.—From Port Nuevo the coast has a general trend of S. 30° E. for 23 miles to the entrance of Bahia Honda and is quite irregular in outline, being intersected by several rivers and indented by a number of small bays, of which the principal are Pajaros, Rosario, and Monita, all of them open and exposed to winds from the westward. About 3¼ miles

southward of Entrada Point is the Tavasera River, which has no bar at its mouth, a channel with from 2 to 3 fathoms leading in to an anchorage ground of considerable extent, with a depth of only 1 to 4 fathoms. Negro Bluff, west of the entrance, is at the southwest end of a round-shaped peninsula about a mile in diameter, occupied by a low hill of gradual ascent and connected with the northern shore by a very narrow neck. Between the Cayado Peninsula and Negro Bluff the coast recedes considerably, forming an open bay, which appears to be free from danger, with 3 to 4 fathoms at one-fourth of a mile from the low shore. The Nueces Rocks lie at the northern end of this bay, the entire group lying within one-fourth mile of the beach.

"Below the Tavasera River the coast is fronted for a distance of 8 miles by a long sandy shelf, called the 'Playa Brava,' extending from 1 to 2 miles from the low shore, with depths of 1 and 2 fathoms, and covering in the southern part the mouth of Lavenia River, 7 miles from the Tavasera. This bank is steep-to, and should be approached with care, keeping outside the 10-fathom line.

"PAJAROS BAY, about 2 miles south of the Lavenia River, between Pajaros and Muertos points, is about a mile in width and depth, with from 16 to 18 fathoms of water. Rosario Bay, separated from Pajaros by a narrow peninsula ending in Muertos Point, is recognizable by the isolated pointed hill terminating this point, and by a small round islet, called 'Muela,' in the middle of the bay, about a mile from the shore. Rosario Point projects into the bay at its middle, dividing it into two parts, the southern of which is called Pivay Bay. A stream discharges at the head of each bay.

"GORDA POINT, of blunt shape and 2 miles broad, separates Pivay from Monita Bay, which is so named from a wooded islet in its northern part near the shore. Ventana Point, limiting Monita Bay on the south, is 1 mile north of Roble Point, which fronts the north side of Medidor Island and is  $2\frac{1}{2}$  miles from the entrance to Bahia Honda.

"These bays, being open to the westward, afford anchorage only in the fine season. In each bay are found a few Indian families, who live by hunting and fishing.

"MEDIDOR ISLAND, of irregular shape and moderate height, about  $1\frac{1}{2}$  miles long and five-eighths of a mile in average width, lies about 2 miles northwestward of the entrance to

Bahia Honda, and is separated from the coast by a narrow and rocky channel less than one-fourth mile wide, which is not recommended for use. Pacora or Trucha Islet, lying three-eighths mile south of Medidor, is about one-fourth mile long and 100 yards wide. A reef extends about two-thirds across the passage, leaving a narrow channel between its end and the islet, with a depth of 24 fathoms. Both Medidor and Pacora appear to be bold and steep-to, the water being from 20 to 30 fathoms deep in their vicinity, but should not be approached too closely on the northern and western sides on account of the deficiency of soundings.

“BAHIA HONDA (deep bay), lying 14 miles northeast of the north end of Coiba Island and 23 miles NW. by W. from Zurron Point, the west end of Cebaco, is an excellent harbor for vessels of the largest size, being deep, safe, capacious, and very easy of access. The entrance, between Guarida Point and Sentinela Island, is seven-eighths mile wide, and the harbor within is 2 miles long and wide, exclusive of the extensive mud flats in the eastern part of the bay, deep water lying in general close to the shores, which, as a rule, are clean and safe of approach.

“GUARIDA, the north entrance point, is bold and clean, and may be approached close-to, there being 20 fathoms of water at from 100 to 200 yards.

“SENTINELA ISLAND, forming the south entrance point, lies seven-eighths of a mile south of Guarida Point. It is small and surrounded by rocks, which, on the south, extend as far as Cono Islet. A detached reef lies about 400 yards to the northeastward. Sentinela and Cono are separated from Cape Jabali by a narrow rocky channel, with rocks on both sides and practicable only for boats.

“Between Guarida Point and Sentinela Island the depths are from 20 to 25 fathoms for almost the entire width of the channel, which is clear and free from dangers, except the rocks and reefs close to the island. Within the entrance the depths decrease gradually to 10 and 12 fathoms at  $1\frac{1}{4}$  miles.

“TALON ISLAND, lying about  $1\frac{1}{4}$  miles within the harbor and opposite the entrance, is about five-eighths of a mile long, north and south, and 120 feet high. Two small islets, Pueril and Espuela, lie respectively off the western and the southern point of Talon, and from the former islet a shoal and reef extend northwestward about one-fourth of a mile.

Talon Island separates the harbor into two anchorages, Chinche Bay to the westward and Legamo Bay to the eastward, the former being much the larger. On the northeast side of the island a narrow channel connects the two bays.

“CHINCHE ISLET is round and wooded, and lies in the northern part of Chinche Bay, about 600 yards from the shore; it is clean and safe of approach on all sides, with 10 and 11 fathoms close-to, to the southward.

“ANCHORAGE may be had in any part of the harbor, but the best berth for large vessels is in Chinche Bay south of the islet, in from 10 to 14 fathoms, mud bottom, sheltered from all winds. The only dangers in this locality are a rock covered by 8 feet of water about one-fourth of a mile northward of Guarida Point, and the reef lying 300 yards northwestward of Pueril Islet. Legamo Bay is clean, with an anchorage extent of three-eighths of a mile and depth of 5 to 7 fathoms, completely sheltered by Talon Island.

“TIDES.—High water, full and change, is at 3h. 10m. Springs rise  $11\frac{1}{2}$  feet, neaps  $8\frac{1}{2}$  feet. The tidal streams run from one-half knot to 1 knot an hour.

“SUPPLIES.—Vegetables and fruit are only obtainable in very small quantities. Water can be procured near a village on the southeast side of the bay; a boat can anchor here in calm weather and fill with a hose. Very good water may also be procured from a cascade outside the harbor on the north shore, at  $1\frac{1}{2}$  miles from Guarida Point. The water falls upon a rock, which affords facilities for fixing a hose.

“Captain de Rosencost states that the Indians are expert turtle catchers and will furnish a large quantity daily. Fish were abundant.

“DIRECTIONS.—The entrance of the bay does not make out well at a distance, but its location is so plainly marked by the islands Afuera, Medidor, and Pacora that it is readily found. After making out Afuera in mid-channel, Medidor will be seen and should be steered for until Pacora is made out or the entrance is opened. Then steer for Guarida Point, which may be ranged close-to, and when past it head for Chinche Islet and anchor in 11 to 14 fathoms, mud bottom, sheltered from every wind. The best time to leave the harbor with a sailing vessel is in the morning, when the winds that precede the sea breeze come from NE. to E. These are sometimes so light that the boats must be used to tow out. The channel

between Medidor and the coast and that between Medidor and Pacora should not be used.

"AFUERA ISLAND lies about midway between the north end of Coiba and the mainland, the channel being  $13\frac{1}{2}$  miles wide. The island may be passed on either side, the only danger being a reef extending from its southeast point about 400 yards; at its extremity is a black rock almost covered at high tide. Afuerita Islet nearly touches the northwestern end of Afuera.

"COIBA OR QUIBO is the largest island off the coast, being 21 miles long, NW. and SE., with a width varying from 4 to 12 miles, and of moderate elevation. It is covered with forests and a dense and tangled tropical vegetation. The interior is said to consist of fine plains covered with magnificent forests, as yet untouched. In all parts there is abundance of good water. Around its shores are numerous anchorages, but no harbor in which a vessel may find protection from all winds.

"The western shore is bold, with deep water close to and clear of dangers not in close proximity to the shore. Hermosa Point is the northwest extreme of the island, and has deep water close outside the rocks and islets off it; eastward of it is Hermosa Bay, open to the northwestward, with a sandy beach at its head. It has not been sounded out, but has 20 and 14 fathoms in the entrance.

"Off the southern coast are several dangers, requiring caution in approaching this side of the island. A shoal nearly a mile in width extends about 5 miles along the shore from Negada Point, the southeast extremity of the island to Racimo Point. Hill Rock, a dangerous detached shoal with 6 feet of water over it, lies at  $2\frac{1}{2}$  miles from the shore, nearly south of Racimo Point, and  $5\frac{1}{2}$  miles S.  $64^{\circ}$  W. of Negada. Several shoal spots of 4 to 5 fathoms lie at  $1\frac{1}{2}$  and 2 miles southwestward of Negada Point, with deeper water inshore. Barca Islet is a little over one-half mile southwestward of Racimo Point. Passage Rocks, a group above water, are about 2 miles west of Barca, and Logan Rock, also above water, lies about a mile northwest of the former, with soundings of 6 to 9 fathoms between them and the coast.

"DAMAS BAY, on the eastern side of Coiba, 6 miles northwest of Negada Point, is the principal anchorage. The bay is about 7 miles wide at the entrance between Fea and Clara

points, and penetrates 4 miles. At its head is a broad sandy flat, through which flows a small stream, the San Juan. There is good anchorage in any part of the bay, the depths gradually decreasing from 30 fathoms in the entrance to 10 and 12 fathoms within one-fourth mile of the flats at the head, which, on account of the considerable rise and fall of the tide, must not be approached too closely. Off the southern shore, between Fea and Observatory points, rocky shoals extend out about a mile and are steep-to, with 10 to 12 fathoms close to their edges. A narrow recess in the reefs here, with 5 to 8 fathoms of water, might with care afford protection from the SE. to a small vessel. From Fea Point to Negada Point shoal water extends one-half mile from the shore, and from Clara Point, for a stretch of 2 miles to the northward, a shoal extends nearly a mile from shore.

"TIDES.—High water, full and change, is at 3h. 10m.; springs rise about 12 feet. The ebb and flow are regular.

"SUPPLIES.—No fruit or vegetables are procurable; turtles abound, but are hard to catch; crabs, cockles, and oysters are plentiful. In the woods monkeys and parrots abound, and in Anson's time there were deer; but the interior is nearly inaccessible from the steepness of the cliffs and the tangled vegetation. Explorers should beware of alligators and snakes.

"ARENA BAY.—At Job Point,  $2\frac{1}{2}$  miles north of Clara Point, the coast turns due west for 2 miles and then again to the northward, forming Arena Bay, in which the depth is convenient for anchoring over a large area; the depth at 2 miles from the shore being only 20 fathoms. At the head of the bay a sandy flat extends out one-half mile, and through it flows the Juncal River, which would appear to be the remarkable cascade described in the account of Anson's voyage. Pesado Rocks lie in the northern part of the bay,  $3\frac{1}{2}$  miles from Job Point and three-fourths mile from the shore, and north of these, about a mile offshore, are the Cocos Islands; outside of these rocks and islands there appear to be no dangers.

"BALTASAR HEAD, the north extreme of the island,  $7\frac{1}{2}$  miles N.  $34^{\circ}$  W. from Job Point, is a bold headland with deep water close-to. The channel between it and the Contreras group has soundings of 40 to 64 fathoms and no dangers except Prosper Rock.

“REMARKS.—The following interesting description of Coiba Island is found in the account of Lord Anson’s voyage around the world, by Richard Walter, the chaplain, published in 1776, thirty years after the voyage. It would seem that the island has changed but little up to the present day. The anchoring place at the *Centurion* was in Damas Bay.

“The island of Coiba is extremely convenient for wooding and watering, since the trees grow close to the high-water mark and a large, rapid stream of fresh water runs over the sandy beach into the sea, so that we were little more than two days in laying in all the wood and water we wanted. The whole island is of a very moderate height, excepting one part. It consists of a continued wood, spread all over the whole surface of the country, which preserves its verdure the year round. Among the other wood we found there abundance of cassia and a few lime trees. It appeared singular to us that, considering the climate and the shelter, we should see no other birds than parrots, paroquets, and macaws. Indeed, of these last there were prodigious flights. Next to these birds, the animals we found in most plenty were monkeys and iguanas, and these we frequently killed for food, for, notwithstanding there were many herds of deer upon the place, the difficulty of penetrating the woods prevented our coming near them, so that, though we saw them often, we killed only two during our stay. Our prisoners assured us that this island abounded in tigers, and we did once discover the print of a tiger’s claw upon the beach, but the tigers themselves we never saw. The Spaniards, too, informed us that there was frequently found in the woods a most mischievous serpent called the flying snake, which, they said, darted itself from the boughs of trees on either man or beast that came within its reach, and whose sting they believed to be inevitable death. Besides these dangerous land animals, the sea hereabouts is infested with great numbers of alligators of an extraordinary size; and we often observed a large kind of flat fish, jumping a considerable height out of the water, which we supposed to be the fish that is said frequently to destroy the pearl divers by clasping them in its fins as they rise from the bottom; and we were told that the divers, for their security, are now always armed with a sharp knife, which, when they are entangled, they stick into the belly of the fish and thereby disengage themselves from its embraces.

“While the ship continued here at anchor, the commodore, attended by some of his officers, went in a boat to examine a bay which lay to the northward; and they afterwards ranged all along the eastern side of the island, and in the places where they put on shore, in the course of this expedition, they generally found the soil to be extremely rich and met with great plenty of excellent water. In particular, near the northeast point of the island they discovered a natural cascade, which surpassed, as they conceived, everything of this kind which human art or industry has hitherto produced. It was a river of transparent water, about 40 yards wide, which rolled down a declivity of near 150 yards in length. The channel it fell in was very irregular, for it was entirely composed of rocks, both its sides and bottom being made up of large detached blocks, and by these the course of the water was frequently interrupted, for in some parts it ran sloping with a rapid but uniform motion, while in others it tumbled over the ledges of rocks with a perpendicular descent. All the neighborhood of this stream was a fine wood, and even the huge masses of rock which overhung the water, and which by their various projections formed the inequalities of the channel, were covered with lofty forest trees.

“RANCHERIA OR QUIBITO is a small island,  $1\frac{1}{2}$  miles by three-fourths mile in extent, lying 2 miles east of Baltasar Head, the north end of Coiba. The channel between the two islands is  $1\frac{1}{4}$  miles wide, with soundings of 8 to 14 fathoms, and appears to be safe by keeping near the shore of Coiba and just outside the Cocos Islands. On account of the numerous rocks and uneven bottom, however, it is not recommended for use. Don Juan Rock, above water, lies nearly in midchannel. Aaron Rocks, a group of islets about a mile northwestward of Rancheria and  $1\frac{1}{4}$  miles northeastward of Baltasar Head, are the outermost dangers in this vicinity.

“There is good anchorage south-southeast of Rancheria, opposite a sandy beach whence wood and water can be easily procured from the island. Some shelter is furnished by a high round islet. A Frenchman named Sorget was resident on Rancheria in 1847.

“JICARON ISLAND, 4 miles south of Coiba, is of triangular form,  $3\frac{1}{4}$  miles long north and south, and well wooded; its highest point, 830 feet high, is on the east side, and the most extensive lookout, says Captain Colnett, is from the top of

this island, for it commands Coiba and the whole of the coast and bay to the northward. David Point, the northeast extreme, is clear and safe of approach, with deep water close to. Around the northwest extreme are numerous rocks and reefs, foul ground extending off three-fourths of a mile. A small group of rocks above water lies  $1\frac{3}{4}$  miles N.  $70^{\circ}$  W. of Ursula Point, the south extreme of the island, and  $1\frac{1}{4}$  miles offshore, closely surrounded by depths of 23 to 27 fathoms. About one-fourth of a mile south of Ursula Point is Jicarita Islet,  $1\frac{1}{4}$  miles long and covered with cocoa palms.

"WEST COAST—JICARON ISLAND—CORRECTED HEIGHT.—The officer in charge of the Branch Hydrographic Office, San Francisco, Cal., reports that the master of the steamer *San Juan*, Captain Alfredberry, states that as the result of observations on four consecutive voyages between San Francisco and Panama he finds the height of Jicarón Island (4 miles south of Coiba (Quibo) Island) to be (approximately) 1,400 feet instead of 830 feet, as given on the chart.

"THE CHANNEL between Jicarón and Coiba is practicable, but of very irregular depth, the best water, not less than 11 fathoms, being nearer Jicarón. Hill Rock, the principal danger in the approaches, lies  $5\frac{1}{2}$  miles east of David Point.

"COAST.—From Bahia Honda the coast trends S.  $68^{\circ}$  E. for  $20\frac{1}{2}$  miles to Brava Point, at the entrance of Montijo Bay, and is rugged, with several islets and rocks off it. At 2 miles from the land the soundings are 35 to 27 fathoms until the vicinity of the point is reached. Lorenzo Bay, about 5 miles westward of the point, is of considerable extent, but apparently foul, and has not been closely examined. In running from one bay to the other the coast should have a berth of not less than 3 miles.

"MONTIJO BAY extends northward about 14 miles, with an average breadth of 9 miles, and is fronted and nearly inclosed by the two islands, Cebaco and Gobernador, which lie in the entrance. Within the bay, near its head, is Leones Island, between which and the north side of Cebaco, a distance of 8 miles, is a continuous shoal with a depth of 2 fathoms, which occupies a large part of the area of the bay and leaves on either side but a narrow channel. Opposite Leones Island, on both sides of the bay, are several small streams accessible only by boat. The bay is of little value to shipping and seldom visited on account of the shoals and very irregular soundings. A closer examination or survey would make its

use quite practicable for steamers and afford to them a safe and sheltered harbor.

"CEBACO ISLAND is of irregular shape,  $13\frac{1}{2}$  miles long, ENE. and WSW., and 3 miles wide at its eastern end, the broadest part. Some detached rocks lie immediately south of its western end, and a sunken rock lies about a mile from its eastern point, leaving no safe channel between. When entering the bay by this, the east, channel, it is necessary on account of this sunken rock to keep nearer to the main than to the island, the depths being 12 to 10 fathoms; steer then for San Juan Rock, distant about  $1\frac{1}{2}$  miles from the land, until a 2-fathom spot in mid-channel  $1\frac{1}{2}$  miles southward of the rock and in line with the east point of Cebaco is passed, and then steer to pass the rock on its west side at about three-fourths of a mile in 4 fathoms; hence, to the east side of Leones Island the course is about north (N.  $6^{\circ}$  W. mag.), westward of several rocks lying offshore, in soundings of 6, 7, and 9 fathoms.

"GOBERNADOR ISLAND, between the west end of Cebaco and the main, is about  $2\frac{1}{2}$  by  $1\frac{1}{2}$  miles in extent, and divides the western entrance to the bay into two channels, either of which is practicable, but the northern preferable because wider and less exposed to the strong outward current from the bay. The depth in the southern channel is 9 to 6 fathoms and in the northern 16 to 6 fathoms. There is good shelter for vessels of light draft under the west shore of the bay, which is easily reached. The banks throughout the bay are steep and require careful attention to the lead; vessels should not go beyond 4 fathoms.

"DUARTIS POINT, the eastern entrance point of Montijo Bay, lies 6 miles southeastward of Cebaco. Foul ground extends from it nearly 2 miles to the eastward.

"THE COAST south of Duarte Point is low and indented by two large bays, with a small stream at the head of each. The Quebra Islets, 6 miles below the point, extend to the westward about  $1\frac{1}{2}$  miles from the bluff projection of the coast separating the two bays. Vessels should keep at least 2 miles from this stretch of coast, as it has not been closely examined.

"At 14 miles south of Duarte is a bluff headland, and one-half mile off it is the rocky but wooded islet Naranjas, which is steep, with deep water close outside.

"MARIATO POINT, 5 miles SE. of Naranjas Islet and 55

miles east (N.  $84^{\circ}$  E. mag.) from the south extremity of Jicarita, is a bold headland marking a sharp turn of the coast. It is the beginning of the range of high coast land which terminates at Morro Puercos.

“LANDFALL.—Mariato Point is a good landfall for vessels bound to Panama from the westward, as by keeping under the land to the eastward of the point they avoid the southerly set-out of the gulf.

“MORRO PUERCOS, 27 miles east of Mariato Point, is a lofty headland forming the termination of the range of high coast land. The water off this coast is deep close to the rocks for two-thirds of the distance, with 100 fathoms within 2 miles of the shore. Nearer Puercos Point the 20-fathom line is about 2 miles from shore. About 4 miles westward of the point and 1 mile from the shore is a reef above water; and 2 miles northeastward of the point,  $1\frac{1}{2}$  miles from shore, is a 3-fathom patch. The chart shows a 5-fathom spot, with 14 fathoms close-to, at  $3\frac{1}{2}$  miles S.  $75^{\circ}$  E. (S.  $81^{\circ}$  E. mag.) from the point.

“COAST.—From Puercos Point to Guanico Point, 7 miles to the northeastward, the coast curves in a double bight, and thence in a larger bight to Raia Point, off which, at one-half of a mile, are the Venado Islet and reef. The Tomosi River is nearly 3 miles northward of Guanico Point, and about the same distance beyond the river, at the head of the bight, is a patch of rocks at a short distance from the shore. About 2 miles westward of Raia Point is the Juera River, mentioned in Findlay as accessible, according to native report, for vessels of any draft, having 10 or 12 fathoms depth, and affording a supply of fresh water.

“From Guanico Point to Cape Mala, 23 miles N.  $66^{\circ}$  E. of the point, the coast is low and along it the depths are moderate.

“NORTH AND SOUTH FRAILES are two low, barren, flat topped islets, of which the southern lies  $11\frac{1}{4}$  miles S.  $46^{\circ}$  W. (S.  $40^{\circ}$  W. mag.) from Cape Mala, and the northern  $2\frac{1}{4}$  miles N.  $28^{\circ}$  W. (N.  $34^{\circ}$  W. mag.) from the southern. A reef extends about 200 yards off the northwest point of the southern islet, but with this exception they are steep-to and clear of outlying dangers, with 20 to 30 fathoms within one-half of a mile of the rocks. Although a good mark for Cape Mala in clear weather, at night or in the thick, squally weather of this coast they are dangerous to vessels keeping under the land

westward of Mala to avoid the current, as the lead gives no warning of their proximity. At such times they should be given a wide berth.

THE GULF AND BAY OF PANAMA—PEARL ISLANDS.

*Variation in 1902.*

Cape Mala ..... 5° 41' E. | Piñas Point ..... 4° 58 E.

“GENERAL DESCRIPTION.—Cape Mala on the west and Piñas Point on the east may be considered the limits of the Gulf of Panama. The line between these points, running nearly east and west, is 105 miles long, and within this line the gulf extends to the northward 92 miles, with the bay and city of Panama at its head. Between the entrance points the 100-fathom line curves slightly to the northward, the depths outside increasing rapidly to 1,000 and 2,000 fathoms, while within they decrease gradually to the head. The Pearl islands are entirely within the 50-fathom line.

“The Isthmus of Panama, which encircles the gulf, is the narrow neck of land connecting the continents of North and South America; in a restricted sense the name is applied to the narrow crossing between Panama and Colon, the two other narrowest crossings being distinguished as the Isthmus of San Blas and the Isthmus of Darien; the widths of the Isthmus at these points, in the order here given, are, respectively, 31, 27, and 32 miles, the last distance being measured from the head of deep-water navigation at the mouth of the Savannah River in Darien Harbor.

“The whole Isthmus is comprised in the Department of Panama of the Republic of Colombia, this department extending from the Costa Rican boundary to the Department of Cauca. All the departments of Colombia, except Panama, are included in South America. The total population of Panama in 1881 was 285,000 persons.

“CLIMATE.—The geographical position of the Isthmus of Panama, the absence of high mountains, and the vast extent of forests and other uncultivated parts tend to produce a hot and rainy climate, which, nevertheless, with the exception of a few localities, as Chagres, Colon, and Portobelo, is said to be healthy and more favorable to Europeans than that of most tropical countries. Diseases of the digestive and integumentary systems are common, and malarial fevers, often of a most pernicious type, prevail throughout the year. The rainy

season is the most unhealthy, especially at its end, when the weather is changing. Yellow fever has prevailed at times in an epidemic form. On board ship Panama is the most healthy place on the coast of Central America. Vessels of war have remained here many months at a time, their crews continuing in a healthy state

“The wet season begins in May and lasts till November. The rains gradually increase until the season is fairly established in June, and continue through July, August, and September, with strong southerly winds. In December the rains cease; the NW. and NNW. winds set in, producing an immediate change. During the dry season regular land and sea breezes blow. The sea breeze sets in about 10.30 a. m. from SSW., generally increases in force until about 3.30 p. m., then gradually subsides, and at sunset is followed by a calm.

“About the end of June the rains are suspended for a short time, the occurrence of this phenomenon being so regular as to receive the name of *Veranito de San Juan*. The average temperature of the year is very high.

“WINDS.—The navigation of the approaches to the Gulf of Panama is for a sailing vessel one of the most tedious, uncertain, and vexatious undertakings known to the seaman. Between Cape Corrientes (latitude  $5^{\circ} 30' N.$ ) and Panama the prevalent winds are from the northward and westward, with frequent squalls from the SW. between the months of June and December. In the Gulf of Panama the winds are regulated by the seasons; the prevalent wind, however, is from the northward. In the fine season, commencing in December, the winds are regular and constant, bringing fine, dry weather. To the southward of the gulf they blow much harder, and off the coast of Veragua<sup>a</sup> a double-reef topsail breeze in January and February is not uncommon. In April and May the northerly winds are less regular and have more westings in them, with calms, light sea and land breezes, and occasional squalls from the southwestward. In June the rainy season sets in and the southerly winds become stronger; still the northwest wind is mostly found after noon, and vessels sailing from Panama will generally have at all seasons a fair wind until south of Cape Mala.

“Between the Galapagos Islands and the coast, westward

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<sup>a</sup>Province of the Department of Panama lying between the Isthmus of Panama and the Isthmus of Chiriqui.

of the meridian of  $80^{\circ}$  W. and south of the parallel of  $5^{\circ}$  N., the winds are between south and west all the year round, and, except between the months of February and June, they are of sufficient strength and duration to make navigation easy; but northward of latitude  $5^{\circ}$  N. and between  $80^{\circ}$  W. and  $110^{\circ}$  W. is a region of calms and doldrums, accompanied by rains and squalls.

“CURRENTS.—The Gulf of Panama is subject to irregular currents, partly caused by the formation of the land and partly influenced by the Peruvian and Mexican streams, according to the varying strength of each. Malpelo Island, which lies about 230 miles S.  $25^{\circ}$  W. of Cape Mala, is surrounded by strong and rapid currents. These have been observed to set in opposite directions, sometimes to the NE. and sometimes to the SW. A steady current has been found to set to the northward after passing Cape San Lorenzo, at the rate of 24 to 36 miles per day, extending offshore about 60 miles. This stream runs along the coast, following the direction of the land, enters and makes a complete circuit of the Gulf and the Bay of Panama, and then sets with considerable force, especially in the dry season, to the southward down the western side of the gulf. After passing Cape Mala it meets the Mexican current from the WNW., causing tide rips, eddies, and the short, choppy sea met with at the entrance to the gulf.

“WEST COAST.—CAPE MALA, which forms the western point of entrance to the Gulf of Panama, is a low but cliffy point with outlying rocky ledges, having deep water close to them. The land from the NW. slopes gradually down to the sea at this point from a considerable distance, making the exact cape difficult to distinguish unless the breakers are seen. On opening the gulf around this cape a strong southerly set is generally experienced, especially in the dry season.

“IGUANA ISLAND, lying about 9 miles to the northward of Cape Mala, is a little higher than the adjacent coast, and thus forms a conspicuous object. A ledge extends about 600 yards from its south point, and the chart indicates a reef as extending about 2 miles ENE. from its east point; also, in 1858, a reef was reported to stretch to the NNE. from its north point; but otherwise the island is steep-to, with 15 fathoms in the channel of about 1 mile in width between it and the main.

“TIDES.—High water, full and change, at Iguana Island is at 4h.; springs rise 15 feet. The flood sets to the northward

and the ebb to the southeast, the latter being considerably the stronger, especially between the months of December and June.

“PARITA BAY, nearly 20 miles wide and open to the eastward, lies within Lisa and Antoine points, the former point being 38 miles NW. of Cape Mala and the latter 40 miles SW. of Chamé Point. From the cape to Lisa Point the shore is a hard bank with sandy beach in front; at the point mud flats begin and extend around the western side of the bay, the coast being a low mangrove shore, intersected by the mouths of no less than five small rivers; the land to the westward is also low, with several hummocks. The coast between the bay and Chamé Point is a continuous beach, named Playa Grande, in front of a low wooded bank. There is a depth of 4 and 5 fathoms about 2 miles off this beach, except S. 22° E. (S. 27° E. mag.) of the Cerro Chamé, where there is only about 4 fathoms at nearly 7 miles from the land, the bank extending from here to Chamé Point.

“OTOQUE AND BONA ISLANDS, with Estiva Islet and Redondo Rock, lying 6 miles southeastward of Chamé Point, form a group similar but smaller than Taboga and Taboguilla, being cultivated and having a considerable village, named La Goleta, in the bay on the western side of Otoque. Otoque and Bona are high and peaked, and form good landmarks for vessels entering this side of the bay. Anchorage in from 10 to 14 fathoms may be found in any part of the group, and all dangers are above water.

“CHAMÉ BAY, at the head of which is a small river of the same name, is nearly filled with large mud banks, the largest, the Cabra Loma, lying in the middle of the bay and on it Tabor Island. Chamé Point, the southern horn of the bay, is a singular, low, woody, projecting peninsula, 5½ miles long and one-half mile wide; between it and Cabra Loma Bank is a convenient harbor, 2 miles long by three-fourths mile wide, with from 3 to 8 fathoms water, there being 16 to 18 feet close to the beach.

“COAST.—The coast from Chamé Point to Bruja Point, a distance of 16 miles, forms a shoal bay, with several outlying banks and rocky islets, and vessels bound to Panama should therefore keep near the Island of Taboga and not approach this shore within the depth of 5 fathoms. The Rio Chorrera discharges at the head of the bay, about 15 miles southwest-

ward of Panama, and on the river, at about 17 miles from Panama, is the town of Chorrera, 180 feet above the sea, with nearly 5,000 inhabitants. Vique Cove, with a small village is 5 miles westward from Bruja Point. About a mile north-east of Vique is a lofty treble-peaked hill, 1,610 feet high, named Cerro de Cabra, a conspicuous object for vessels bound to Panama, and frequently mistaken for Taboga by those coming from the eastward.

“VALLADOLID ROCK, with 10 fathoms close-to, lies 6 miles north of Otoque Island and  $6\frac{1}{2}$  miles northeast of Chamé Point.

“CHAMÉ ISLAND lies 2 miles northeast of Valladolid Rock, with 7 to 10 fathoms close outside. Perique Rock lies close to the north extreme of the island.

“TABOGA ISLAND, with the islands of Urava and Taboguilla, forms a pleasant group, about 4 miles by 2 miles in extent, lying 9 miles south of Panama. Taboga, the highest and largest island, 935 feet high, is well cultivated, with a large village on its northeast side. Northward of the village is the Morro of Taboga, a small hill connected with the main island by a sandy neck covered at high water. This island is occupied by the Pacific Steam Navigation Company, which has here some stores, a water tank with abundant supply of water, and a gridiron 300 feet long.

“THE ANCHORAGE off the village is convenient, being about 600 yards from the shore, in 10 fathoms, with the peak of Urava in range with the high cliff of Taboga, and the church bearing between southwest and west.

“URAVA is a small lofty island separated from the southeast end of Taboga by a narrow and shoal channel; off its south extreme is the small islet of Terapa.

“TABOGUILLA, 710 feet high, also well cultivated, with some islets off its southwest extreme, is the northeast island of the group, with a wide and deep channel between it and Urava, and in the middle of the channel a rock which uncovers 4 feet at low-water springs; the sea seldom breaks over the rock at high water, and it must be carefully avoided by closing either island, both being steep-to, or by keeping the neck of the Morro open, bearing N.  $57^{\circ}$  W. (N.  $62^{\circ}$  W. mag.), and passing south of it. Farallon, a small islet, also lies in this channel and is steep-to, with 10 fathoms between it and Taboguilla.

“MELONES, a small rocky islet, lies  $2\frac{1}{2}$  miles northwest of

Taboga, with the Melones rock, above water, one-half mile to the northward of it.

"BRUJA POINT, about 5 miles northward of Taboga Island, is a rocky, projecting point, marking a turn of the coast. Venado, Cocovi, and Cocoviceta islets lie southwestward of the point, all within a distance of  $1\frac{1}{2}$  miles; and Tortola and Tortolita islets lie about 2 miles southeastward of the point and  $3\frac{1}{2}$  miles north of Taboga; these islets are all within the 3-fathom curve. From Bruja Point to the City of Panama shoal water extends about 2 miles from the shore and envelopes all the islands on this side of Panama road.

"BATELE POINT,  $1\frac{1}{2}$  miles northeast of Bruja, is the south extreme, 102 feet high, of a large, round, hilly projection which forms the western side of Panama road. Changarmi Island, surrounded by the Pulperia Reefs, with Panamarca Rock at their northern end, lies  $1\frac{1}{2}$  miles S.  $68^{\circ}$  E. from the point.

"GUINEA POINT,  $1\frac{1}{2}$  miles northward of Batele Point, is the north extreme, 320 feet high, of the hilly projection above mentioned. From here to the city of Panama,  $2\frac{1}{2}$  miles to the northeastward, the shore line recedes in an extensive bight, filled with mud flats, and is broken by the mouths of the Farfan, the San Juan, and the Grande, small rivers with cultivated banks. La Boca, at the mouth of the Rio Grande and about  $1\frac{1}{2}$  miles west of the city, is the railway terminus, where connection with ship is made.

"NAOS, CULEBRA, PERICO, AND FLAMENCO ISLANDS, with the outlying islet of San José, are a group in the southwestern part of Panama road, Perico, 335 feet high, lying about 6 miles northward of the north extreme of Taboguilla and 2 miles southward of the city. Naos, 167 feet high, is connected with Culebra and Perico by a neck of sand and rocks, covered at high water. The passage between Perico and Flamenco is shoal and should not be used except by boats, but that between Flamenco and San José has 5 fathoms in mid-channel and no dangers. Flamenco is 344 feet high.

"Naos is the headquarters of the Pacific Mail Steamship Company, which has here machine shops, and a depot for fresh water, coal, and supplies, which articles can be obtained from the company. The bay on the northern side of Naos and Perico forms a convenient anchorage, and on the isthmus connecting the two islands, which is sandy on the

north side, steam vessels of 2,500 tons have been easily beached. A channel has been cut by the tides around the eastern end of Naos Island, through which the anchorage north of the island may be reached with a draft of 20 feet at mean low water.

"LA BOCA CHANNEL has been dredged across the flats that fill the bight southward of the city, so as to connect the anchorage northward of Perico Island with the Panama Railroad terminus at La Boca, on the east side of the mouth of the Rio Grande, this being also the terminus of the Panama Canal. A large iron pier for vessels has been constructed at La Boca, and in the basin adjoining it the depth at mean low water was stated by the Panama Railroad Company in June, 1901, to be nowhere less than 29 feet. The channel is well marked by ten pairs of buoys, and five additional buoys mark the west side of the basin opposite the pier. These buoys, while intended to be, respectively, red and black, show with the color of rusty iron. The railroad company possesses and maintains in readiness for use an extensive dredging plant for the purpose of keeping this channel deep enough for ocean steamers.

"PANAMA—LA BOCA CHANNEL—DREDGING OPERATIONS.—Information dated May 21, 1902, has been received from the Panama Railroad Company that the work of dredging the seaward end of La Boca Channel is progressing rapidly, establishing a depth of 21 feet at low water spring tides. The work will be continued until approximately that depth is established in the channel up to the pier and basins, at which a much greater depth is maintained.

"LA BOCA WHARF" was built by the canal company, but has been turned over to the railroad company. During its construction its failure was predicted on account of the great rise and fall of the tide and the difficulty of keeping open the channel leading to the wharf, as a great amount of mud is brought down by the San Juan River. The difficulties have been reduced to a minimum. Vessels are not lashed alongside the wharf, but have floats placed between them and the wharf, so that there are no bad results from the tide. The cranes or winches on the wharf are of a special kind that permits the working of cargo at all stages of the tide.

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"Report of vice-consul-general, June 15, 1901.

"The following measurements give, in feet, the size and capacity of the wharf: Total length, 985; total width, 54; depth of channel alongside at high tide,  $45\frac{1}{2}$ ; at low tide,  $26\frac{1}{2}$ ; width of channel alongside, 98; capacity of vessel space, 985; railroad tracks, 2; total length of railroad track,  $787\frac{1}{2}$ ; car capacity of tracks, 39; cranes, 6 of 2 tons and 1 of 20 to 24 tons; tonnage of largest vessel yet docked, 4,600 tons.

"The basin in which vessels lie has a maneuvering space of 486 feet. The bottom is soft mud, and while it is considered best for the vessels to be at all times afloat, yet they can rest safely in the muddy bottom.

"From the above it is seen that any vessel of 500 feet length and not drawing more than 26 feet can be handled at this wharf with facility.

"The wharf is constructed entirely of steel, and is roofed over and housed in with corrugated iron. The rates charged for vessels coming alongside are governed for the most part by contract.

"LOS HERMANOS ROCKS are three black rocks, visible at first-quarter ebb, lying nearly one-half mile south of the southeast bastion and 300 yards from the reef; detached rocks with 3 and 7 feet of water between them, visible only at low-water springs, lie off their southeast extreme, the outer one being 400 yards from the reef.

"BUEY POINT, seen only at half tide, is the northeastern extremity of the rocky ledge or reef that surrounds the eastern and southern shores of the peninsula occupied by the city, with a width of from 500 to 1,000 yards. Immediately south of Buey Point, which lies 900 yards eastward of the northeast bastion, a deep indentation in the reef forms a bay in which, after half flood, there is easy landing on the sandy beach in front of the Monks' Gate. The reef is marked by iron posts.

"PETILLO POINT,  $1\frac{1}{4}$  miles northeastward of the city, is a black rocky promontory with two small hills over it, and between them a rivulet admitting boats at high water; rocky ledges extend 300 yards from the point. Between Petillo Point and Buey Point the shore recedes nearly three-fourths mile, forming a bay called El Puerto, the head of which is of mud, edged with a sandy beach, and the greater portion dry at low-water springs. It is here that most of the minor trade of the gulf is carried on by means of bungs (large canoes

made from trunks of trees, some of them, though, made of a single trunk measuring 12 tons). Though clumsy in appearance, they are well fitted for the navigation of the gulf, and bring to the city most of the tropical productions of the Isthmus.

“THE KNOCKER AND TABOGA are two rocks with only 6 feet of water on them, the former nearly five-eighths mile S.  $86^{\circ}$  E. (N.  $89^{\circ}$  E. mag.) from the southeast bastion, and Taboga about 300 yards southwestward of the Knocker. A stranger should not attempt to pass west of the red buoy marking the Knocker, this being in 14 feet about 300 yards eastward of the rock, which has near it depths of 8 to 12 feet. Shoal patches with 10 and 11 feet lie outside the buoy at from 400 to 800 yards from the Knocker.

“SULPHUR ROCKS.—This dangerous reef, lying about a mile northwest of the Danaide and  $1\frac{1}{2}$  miles eastward of the southeast bastion, is about one-fourth mile in extent, north and south, and has a rock awash in its center, with 6 and 9 feet around it, and outlying patches of 12 and 14 feet. The reef is marked by a red buoy on the southern side. The railroad flagstaff, in line with the center of Mount Ancon, bearing N.  $89^{\circ}$  W. (S.  $86^{\circ}$  W. mag.), leads northward of the reef in 15 feet, but this passage should not be used at low-water springs.

“DANAIDE ROCKS.—These four patches of conical rocks, lying on the eastern side of the Panama Road, about  $2\frac{1}{4}$  miles northeastward of Perico Island and  $2\frac{1}{2}$  miles southeastward of the city, have only 15 to 18 feet on them, with  $3\frac{1}{2}$  and 4 fathoms on all sides. They lie awkwardly in the track of vessels standing for the anchorage from the eastward and keeping their luff with the land breeze. These shoal spots are favorite fishing places, and canoes seen in their vicinity should be avoided by vessels, as they may be fishing on the rocks.

“CLEARING MARKS.—The south steeple of the cathedral kept midway between the east and southeast bastions, N.  $61^{\circ}$  W. (N.  $66^{\circ}$  W. mag.), leads southward of all the Danaide patches; the Hermanos rocks in range with the hill, 252 feet high, between the rivers Farfan and Grande, S.  $84^{\circ}$  W. (S.  $79^{\circ}$  W. mag.), leads to the northward of the patches and southward of Sulphur rocks.

“PANAMA ROAD, the anchorage off the city of Panama, al-

though shoal and on the seaward side entirely unprotected, may be considered secure. The bottom, being of mud, holds well, and with good ground tackle and common precaution a vessel might lie here with one anchor down all the year round. Attention to the tides and soundings will enable a vessel to lie close-in at times for discharge of cargo. The new dredged channel leading to the railroad terminus at La Boca enables vessels to discharge and load at the pier.

"The inner anchorage is in 2 fathoms about a mile eastward of the northeast bastion; the outer anchorage is in  $3\frac{1}{2}$  to 4 fathoms about 2 miles southeastward of the city, or in 5 to 6 fathoms northeastward of Perico Island.

"LIGHTS.—A fixed red light, visible 3 miles, is shown at the end of the railroad wharf north of the city.

"A fixed red electric light, maintained by the city to illuminate the promenade, is shown at an elevation of 64 feet above low-water mark from a pole standing 100 feet north of the corner of the southeast bastion, and is the highest electric light seen from the bay. This light is made on rounding Taboguilla, being then, in ordinary weather, distinctly visible, and is used as a leading light by the Pacific Mail steamers, giving them at night the direction of San José Rock by shutting the light out behind the rock.

"TIDES.—High water in Panama Road, corrected establishment, is at 3h. 2m.; low water at 9h. 12m.; mean range of tides, 13 feet; of springs, 17 feet; of neaps, 8 feet. The average times of high and low water are a trifle earlier at La Boca and the range of the tide somewhat greater, the mean range of spring tides being 20 feet.

"The datum plane for the *Ranger's* survey of the harbor of Panama in February and March, 1900, is mean low water as determined by the Panama Canal Company's observations, extending over a period of five years, at its tide-gage station at the northeast end of Naos Island.

"TIDAL STREAMS.—The flood stream sets to the northwestward and the ebb stream to the southward, the strength varying from one-half knot to  $1\frac{1}{2}$  knots per hour, the ebb being stronger than the flood. The long swell which occasionally sets into the road ceases with the flowing tide.

*Tidal streams in Panama Harbor, as observed by the U. S. S. Ranger in February and March, 1900.*

Station.	Half flood.			Half ebb.		
	Range of tide in feet.	Set.	Drift in knots per hour.	Range of tide in feet.	Set.	Drift in knots per hour.
Eastward of Perico and Flamenco islands.	21	NW. $\frac{1}{2}$ N.	0.6	20	SE. by S.	0.6
Knocker buoy	17	NW.	.5	16	S. by E.	.6
Entrance to La Boca Channel.	17	W. by N.	.4	21	S. by E.	.7
Halfway up La Boca Channel.	17	WNW.	1	21	SE. by E. $\frac{1}{2}$ E.	2.2
La Boca basin, halfway between pier and inner-channel buoys.	17	W. by N.	1	20	SE. $\frac{1}{2}$ E.	1.5

"PANAMA CITY, the capital of the Department of Panama, with a population estimated in 1901 at 20,000, of which the foreign element, mostly Jamaican negroes, forms about one-half, the Americans numbering about 100, stands on a rocky peninsula jutting out into the shallow water at the head of the bay, and was formerly a strongly fortified city. It has a noble appearance from the sea; the churches, towers, and houses, showing above the line of the fortifications, stand out from the dark hills inland with an air of grandeur. About a mile westward of the city, to which it forms a pleasant background, is Mount Ancon, a beautiful hill, 630 feet high. On each side of Ancon are flat hills, with copses of wood and savannas, grassy slopes, and wild thickets, while to the southward the cultivated islets of Perico and Flamenco complete a scene which, says Dampier, makes 'one of the finest objects that I ever did see, in America, especially.'

"The expectations formed in viewing the city from the sea are by no means realized on landing. The principal streets extend across the peninsula and are intersected by the Calle Real running east and west, which has a quiet and stately but comfortless air. The houses are of stone, mostly in the old Spanish style, the larger ones with courts and patios. The public edifices, comprising cathedral, churches, convents, nunnery, college, theater, and market, are partly in ruins. The cathedral, a large lofty building on the west side of the plaza, is hardly worthy of its situation, only the towers redeeming it from insignificance and forming in the distance an ornament to the city. The fortifications were well con-

structed, but are in partial ruins, the northeast bastion having fallen in 1845. The south and west ramparts are in fair condition and form a pleasant promenade. Drainage is neglected, though the elevation of the peninsula on which the city stands, together with the great rise and fall of the tide, offers considerable advantages for cleansing, a duty at present performed by the heavy rains of the wet season. In 1901 the police force of the city, numbering 150, was reported as efficient, well uniformed, and well armed. The city was under martial law.

"THE OLD CITY of Panama, built in 1518, which was taken and destroyed by the buccaneers under Morgan in 1673, stood at the mouth of a creek, about 4 miles northeast of the present city. Old Panama was larger than the Panama of this day and a place of surprising wealth. The spot is now deserted, but well marked by a tower, an arch, two or three piers of a bridge, and some fragments of wall. In the afternoon the tower is still a conspicuous object from the anchorage.

"WEATHER.—The following brief synopsis of the weather at Panama is by Mr. J. H. Smith, long a resident of the city:

"JANUARY, FEBRUARY, AND MARCH.—Fresh north winds, fine weather, and clear sky.

"APRIL.—North winds decreasing, with frequent calms and light southerly airs in the day; latter end of month, occasional squalls from the north in the afternoon, with rain, thunder, and lightning.

"MAY.—During the day frequent calms and light southerly winds, weather becoming cloudy, and occasional fresh squalls from northeast to southeast, with rain.

"JUNE.—The rainy season well set in, breezes during the day increasing from the south, with squalls and heavy rain; nights generally clear, with light land breezes from the north; latter end of month eight or ten days of fine weather frequently occur.

"JULY, AUGUST, AND SEPTEMBER.—Moderate south winds, squalls, and rain; during the equinox four to six days of strong south winds without cessation during the night, and frequent squalls with rain.

"OCTOBER.—South winds, squalls, and rain; frequent land winds at night and fine west winds.

"NOVEMBER.—South winds decreasing, with frequent intervals of fine weather and occasional squalls off the land.

“DECEMBER.—First part, frequent calms and light south winds during the day; latter part, occasional north winds and fine weather.

“SANITARY CONDITIONS.—The habits of the people are in general most uncleanly and the sanitary condition is bad. Yellow fever, remittent, bilious, and pernicious fevers are endemic, and yellow fever was considered epidemic in July, 1885. No reliable information can be obtained as to the mortality of the port; it has been reported as high as 40 per diem during the sickly season. The most sickly parts of the year are at the changes of the seasons. It is considered that the prevailing direction of the wind has some influence on the sanitary state—that the northwest winds are healthful and the southeast winds unhealthful. During the wet season calms and light variable winds prevail, the air is laden with moisture, and it is very oppressive. At the canal company's observatory on Naos Island the highest temperature was 102° F. and the lowest 66° F.

“HOSPITALS.—The foreign hospital, built and owned by the canal company, situated on high ground at the foot of Mount Ancon, is well managed and clean, with a capacity of about 2,000. The cost of occupation is \$2 and \$5 per day for a separate room. Two regular physicians are in attendance. A sanitarium on Taboga Island is connected with the hospital.

“The St. Thomas Hospital, a charity institution, situated in the city and subsidized by the Government, is dirty and not well kept. The capacity is about 100 and cost of occupation \$1 per day.

“SUPPLIES.—Supplies may be had, but it is considered unsafe to buy them on account of the bad sanitary condition of the place and the consequent danger of infection. Lighters for the transportation of stores may be hired from the railway company. Fresh provisions in ample quantity and of fair quality can be purchased as required. Prices paid by the U. S. S. *Iowa* in October, 1901: Fresh beef, 12½ cents; vegetables, 8 cents; bread, 8 cents. All kinds of fruit are obtainable. Ice can be obtained in large quantities. Sand is obtained from Perico Island. Good water can be obtained from the Pacific Mail Steamship Company at Flamenco Island or from the Pacific Steam Navigation Company at Taboga Island, being brought alongside and pumped into the tanks by steam pumps at a cost of 2 cents per gallon. The

*Iowa* was supplied by the Panama Railroad Company, by steam water boat, capacity 50,000 gallons, at 0.9 cent per gallon.

“COALING FACILITIES.—Cumberland, Cardiff, Welsh, New Castle, and Australian coal can be obtained from the Panama Railroad Company, the Pacific Mail Steamship Company, and the Pacific Steam Navigation Company, which companies keep large quantities on hand, though it is said that the steamship companies will not part with any coal when it can be purchased elsewhere. The coal is delivered alongside in lighters holding from 150 to 250 tons, at a cost per ton of from \$13 to \$17. Coal may be obtained directly from the ship or collier, which greatly lessens the danger of fever. The *Iowa* was supplied by the Panama Railroad Company with 100 tons per week of Pocahontas coal, at \$9.50 gold per ton; supply reported as plentiful.

“TELEGRAPH AND POSTAL COMMUNICATION.—Panama is connected by cable with South American and Central American ports, and by land line with Colon, and thence by cable with Jamaica and the West Indies. The line to the United States and Europe is by way of the Tehuantepec Isthmus, the City of Mexico, and Galveston, Tex. Postal communication with the United States is by the Panama Railroad Company's steamers from Colon; with Central America, Mexico, and San Francisco by the Pacific Mail and other steamers, and with South American ports by the steamers of the Pacific Steam Navigation Company and the South American Steamship Company. Mails from the United States are at times irregular.

“STEAMER LINES.—Panama is a terminal point or port of call of four lines of steamers, viz:

“(1) The Pacific Mail line to San Francisco, three times a month, calling at Central American and Mexican ports.

“(2) The Panama Railroad Steamship line to San Francisco direct.

“(3) The Pacific Steam Navigation Company's line from Coronel, Valparaiso, and intermediate ports to San Francisco and intermediate ports; also line of this company from South American ports to Acapulco and way ports; and line from South American ports to Ocos and way ports.

“(4) The Compañía Sud-Americana de Vapores Line, with the same itinerary and alternating in service with the pre-

ceding company, Lota (Chile) being the extreme southern point, however, instead of Coronel.

"The rate for first-class passengers from New York to San Francisco is \$105, and from New York to Valparaiso \$240.

"COMMERCE.—The commerce and trade of Panama is naturally divided into two parts, the local and the transit. The latter is also divided into two parts, that with the United States and that with Europe. The entire local trade of Panama with the United States for the year 1885 amounted to \$3,728,961 of exports and \$4,263,519 of imports.

"The local exports are india rubber (which is becoming scarcer), gold dust, hides, ivory nuts, manganese, shells, tobacco, cocobolo (a cabinet wood), tortoise shells, vanilla, whale oil, sarsaparilla, cocoanuts, and fruit. From South America the bulk of the shipments consists of bark, cotton, cocoa, and rubber; from the Central American States, of coffee, sugar, and indigo.

"Panama is normally a free port, but import duties are levied on tobacco in all its forms, salted or preserved meats, wines, spirits, ales, beer, ginger beer, cider, salt, etc. Recent reports state that there is a customs duty of 15 per cent on all goods, with an increase on spirits.

"IN SHIPPING STORES for naval vessels on the coast to the care of the consul-general at Panama it is absolutely necessary that they should be accompanied by complete invoices stating the contents of each package, the weight thereof, and the cost value. Small parcels must also be accompanied by a statement of contents and value addressed to the consul-general or to the person to whose care they are consigned.

"MACHINE SHOPS.—The Pacific Mail Company has a small machine shop on Naos Island for repairing vessels of the line, and the Pacific Steam Navigation Company has a similar one at Taboga Island. There are no docks at Panama; the grid-iron at Taboga is the only means of effecting repairs to vessels' hulls.

"LANDING PLACE.—The general landing place at high water is around Buey Point inside the northeast bastion, at the market place known as 'the steps.' Great care is required when landing at Panama in steam cutters or other heavy boats, which can be effected only at nearly high water. Landing is made in small boats from ships' boats at Hotel Marina landing. Boats going in should pass southward of the outer

white beacon and leave all the other beacons on the port hand.

"THE PANAMA RAILROAD, 47 statute miles long, extending to Colon, on the Atlantic side of the Isthmus, is an asset of the bankrupt Panama Canal Company, which holds nearly all of the stock. Culebra, the station at the highest point of the road, is probably, with the exception of the Nicaragua divide, the lowest point in the range of mountains that extends from North America all the way through South America, being 252.4 feet above mean sea level.

"The road, which was built by an American company between 1850 and 1855, is a broad-gage, single-track line, with a maximum grade of 76.6 feet to the mile. The rate for first-class passengers between Panama and Colon, formerly \$25, is now \$4 in American gold.

"At Colon connection is made for ports of the Spanish Main, the West Indies, and all parts of Europe by steamers of the Royal Mail Steam Packet Company, Leyland Line, Harrison Line, Compagnie Generale Transatlantique, Hamburg-American Packet Company, La Veloce (Italian), and Compañia Transatlantica Española. The steamers of the Panama Railroad Steamship line leave Colon for New York every Tuesday; time seven days.

"THE PANAMA SHIP CANAL, to connect the Atlantic and Pacific oceans, is planned to follow much the same route as that of the railway from Colon to Panama, the length to be 49.09 statute miles from the 6-fathom line in the harbor of Colon to the 8-fathom line in Panama road, and the depth 35 feet, with a minimum bottom width of 150 feet, as planned for the Nicaragua route. The special difficulties to be encountered are the deep cut of the summit level at Culebra and the Bohio Dam for the impounding and control of the waters of the Chagres River and its tributaries. The summit level of the canal, that of Lake Bohio, this level being carried completely through the Culebra Cut, will be nearly 22 miles in length and in general 85 feet above mean sea level, with extreme fluctuation between 82 and 92 feet. It will be reached by two locks on the Atlantic side, both at the Bohio Dam, and by three locks on the Pacific side, two at Pedro Miguel and one at Miraflores, the latter point being 1.33 miles nearer Panama. The cost of construction to complete the canal on these lines, taking advantage of the work already done, is

estimated by the Isthmian Canal Commission at about \$145,000,000.

"The natural attractions of the Panama route lie in the combination of a very narrow isthmus with a low summit. The width of the Isthmus in a straight line is less than 35 statute miles, while the summit is barely 300 feet above mean tide, which, though higher than the Nicaragua summit, is less than half the height of any other that has been investigated. The high portion of the Isthmus is limited to a width of about 6 miles near the Pacific side, and the Chagres River affords access by canoe navigation to within 15 miles of the Pacific Ocean.

"CONSULS.—The United States is represented at Panama by a consul-general and a vice-consul-general, Great Britain and France by consuls, and many other countries by honorary consular officers.

"PORT OFFICIALS.—There is a captain of the port, who is also the health officer, but it appears that he does not board incoming vessels and quarantine is not very strictly enforced.<sup>a</sup> The quarantine station is near Taboguilla Island. Pilots are not required except for La Boca channel, for which the pilot is furnished by the Panama Railroad Company.

"OFFICIAL CALLS.—The governor of the Department of Panama and the President of the Republic, when present, are the only native officials to be called on. A saluting battery has recently been established on shore and salutes are promptly returned.<sup>a</sup>

"DIRECTIONS.—Sailing vessels bound to Panama, especially between December and June, should endeavor to get within 3 or 4 miles of Chepillo Island, which lies near the coast north of the Pearl Islands, and so have all the advantage of the northerly wind. From this position Ancon Hill, behind the city, will be seen and should be kept a little on the port bow, as the wind draws to the westward on approaching the city. Vessels drawing over 18 feet should pass south of the Danaide Rocks by keeping San José Rock open to the westward of Taboga Island until the cathedral towers are open to the northward of Ancon. Having passed the Danaide, the ship is fairly in the road and may anchor according to her draft. If not more than 18 feet, she may have Tortola just shut in by

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<sup>a</sup>Report from U. S. S. *Iowa*, September 9, 1901.

Naos, bearing S. 30° W. (S. 25° W. mag.), and San José open east of Taboguilla. Larger vessels, drawing 24 feet, may anchor northeastward of Perico, with Urava Peak in range with the east point of Flamenco bearing S. 6° W. (S. 1° W. mag.), taking care not to open Changarmi northward of Perico. If necessary to work up the road to an inshore berth, a vessel should tack on the western side just before Perico and Flamenco touch, and in standing to the eastward avoid closing San José with Taboga Island, or Tortola with Flamenco.

"Vessels drawing 14 feet may pass northward of Danaide and south of Sulphur Rock, with Hermanos Rocks on with the right side of the peak between the rivers Farfan and Grande; then San José Rock on with the peak of Taboguilla, bearing south (S. 5° E. mag.), leads between Sulphur Rocks and the Knocker to an anchorage north of the buoy, in 16 feet, keeping it between Perico and Flamenco, with Gabilan, a rocky peninsula west of the town, just shut in by the southeast bastion. During neap tides anchorage more to the northwest may be taken.

"COAST.—From Petillo Point to the Chepo River an extensive mud flat borders the coast the entire distance, fronted by a shoal bank, the edge of which lies from 3 to 5 miles from shore. Numerous small streams intersect the shore line. Vessels should not stand into less than 6 fathoms between Panama and Chepillo Island.

"CHEPO RIVER, which enters the Bay of Panama about 25 miles eastward of the city, comes from some distance in the interior, its source being far to the eastward, near the headwaters of the Savannah River. The entrance is to the westward of Chepillo Island, through a 10-foot channel about 600 yards wide. A small hill with a cliff under it on the eastern bank, steered for on a bearing N. 54° E. (N. 49° E. mag.), will lead through the deepest water.

"THE SAN BLAS CANAL ROUTE, much recommended by the narrowness of the Isthmus at this point (27 miles), was carefully examined in 1870 by Commander Selfridge, U. S. Navy. The route ascends the Chepo River 12 miles, and then the Mamoni, a tributary from the northward, to its source; thence it crosses the divide, with an elevation of 1,142 feet, and descends by the Mandinga River to the Gulf of San Blas. A tunnel of 10 miles would be required to connect cuts of 190 feet on either side of the divide. For the remaining 16 miles

the excavation would not exceed an average of 60 feet. The vast expenditure for so long a tunnel renders this route, otherwise so prepossessing, of questionable practicability.

"The most complete plan developed by the Isthmian Canal Commission for this route involves a tunnel at least 7 miles long, which, while considered not necessarily impracticable, would be very objectionable, and renders this line inferior to that of Panama or Nicaragua.

"TIDES.—High water, full and change, at the mouth of Chepo River is at 3 h. 40 m.; tides rise about 16 feet.

"CHEPILLO ISLAND, described by Dampier as the most pleasant island in Panama Bay, lying off the mouth of Chepo River about 24 miles eastward of Panama and 2 miles from the coast, is 1 mile long by one-half mile broad, and very fertile. It is low on the north side, and rises by a gentle ascent toward the south end, over which is a remarkable tree that forms an excellent mark to vessels bound up the bay. The south end may be approached within a mile, but the other sides are shoal, and a reef extends three-fourths mile off the north point, following the direction of the channel.

"PELADO ISLET, lying  $31\frac{1}{2}$  miles southeastward of Chepillo Island and 4 miles west of Mangue Islet, directly off the mouth of Chiman River, is flat, of small extent, about 60 feet high, and treeless, but covered with a coarse prickly shrub; it is steep-to on all sides and forms a useful mark for vessels bound to Panama.

"THE COAST between Chepillo Island and Pelado Islet consists of low river land with mangrove bushes. Of the several small streams, the principal are the Hondo and Corutu, both being shoal at the entrance. The land north of these rivers is of some elevation; Column Peak and Asses' Ears, about 12 miles north of Chiman River, and Thumb Peak, at the west extreme of the range, are conspicuous. Extensive mud flats, dry at low water, extend from 1 to 4 miles from the coast, and outside of the flats is a shoal bank the outer edge of which lies 7 miles from the shore. Vessels standing in shore should tack in 9 fathoms.

"CHIMAN RIVER, 32 miles southeastward of Chepo River, is wide at the mouth, but shoal, being nearly dry at low water, with small channels for canoes. The entrance is well marked by the wooded bluffs on each side, the Mangue Islet to the southward, and Pelado Islet in the offing. On the eastern side,

under a hill, is the small village of Chiman. This is the point to which Pizarro retired in 1525 after beating about for seventy days, with much danger and incessant fatigue, without being able to make any advance to the southward. He was here joined by Almagro, and the following year they sailed again for Peru.

"MANGUE AND MAJAGUAY are high and wooded islets lying, respectively, 3 miles and 2 miles south of the east entrance point of Chiman River, and at the western edge of a large mud flat, dry at low water, which extends to the north bank of Trinidad River. There are 10 to 12 feet of water to the westward of the islets.

"TRINIDAD RIVER, about 9 miles southeastward of Chiman River, has a low rocky projection forming its southern point of entrance. A 3-fathom channel was found into this river, extending  $1\frac{1}{2}$  miles from the point, beyond which distance it was not examined. The northern bank of the river is composed of mangroves, which continue along the coast from here to Panama, a distance of nearly 70 miles, except where interrupted by the bluffs of the rivers Chiman and Chepo. Shag Rock, a barren islet with shoal water around it, frequented by birds, lies  $2\frac{1}{2}$  miles northward of the entrance.

"THE PAJAROS are two small rocky islets, lying between 2 and 3 miles south of the south entrance point of Trinidad River and  $1\frac{1}{2}$  miles from the coast, with 4 and 5 fathoms off their west sides, but only 12 feet between them and the shore. From Chamé Point, southwest of Panama, to these islets, the whole shore of Panama Bay is fronted by a shoal with 5 fathoms on its outer edge.

"SOUTH FARALLON INGLES is a small but high island, lying about 8 miles southward of the Pajaros and 19 miles southeastward of Pelado Islet, at the edge of the shoal off the river Buenaventura, with 12 and 15 feet of water on its western side. North Farallon lies three-fourths mile to the northward and three-eighths mile from the west entrance point to the river. It was in this river, in 1681, that Dampier and his party, being prevented by the Spaniards from going by way of the Santa Maria or Chepo rivers, sank their ship when starting on their journey to the Atlantic; this they reached in twenty-three days at a point near Concepcion cays, 60 miles westward of Golden Island in Caledonia Bay, having traveled 110 miles and crossed some high mountains, though their

common march was in the valleys, among deep and dangerous rivers.

"GORDA POINT, 4 miles northward of the South Farallon, is bold and woody, with 4 fathoms close-to; above this point there is less swell than to the southward of it.

"BRAVA POINT and San Lorenzo Point, 2 miles to the eastward of Brava, lie on the north side of the entrance to San Miguel Bay; both are edged with reefs and outlying rocks on which the sea breaks with great violence, and this fact, together with the proximity of the Buey Bank, makes this part of the coast dangerous, and it should be avoided even by small vessels.

"BUEY BANK, lying about a mile south of Brava Point, in the northern part of the entrance to San Miguel Bay, is an extensive shoal about 3 miles in diameter, which dries in patches at low water and on which a heavy sea breaks. A passage five-eighths mile wide, with 4 to 5 fathoms, lies between the bank and the shore, but subject to a heavy swell and not recommended for use. A spit with 12 feet of water extends  $1\frac{1}{2}$  miles off the southwest side of the bank, and outside the spit the water deepens very gradually, the 5-fathom line lying about 3 miles to the westward and 2 miles to the southward.

"SAN MIGUEL BAY, on the eastern side of the Gulf of Panama, is  $15\frac{1}{2}$  miles wide between the entrance points, Brava on the north and Garachiné on the south, and penetrates within the points about 20 miles to the eastward. Between San Lorenzo Point and Patena Point to the southeastward, the bay narrows to about  $7\frac{1}{2}$  miles, expands again within to 11 miles, and again narrows to  $4\frac{1}{2}$  miles between Pierce and Virgin points; thence continues a curved and gradually narrowing channel, terminating in the land-locked and spacious Darien Harbor, formed by the junction of the rivers Savannah and Tuyra.

"Across the entrance of the bay and for about 9 miles seaward extends a flat bottom with depths from 5 to 8 fathoms, but the water gradually deepens within the bay, and through the Boca Grande the depths are from 11 to 16 fathoms. Across the entrance flat a depth of  $7\frac{1}{2}$  fathoms can be carried, and thence to Darien Harbor more than 8 fathoms.

"San Miguel Bay was well known to the buccaneers, who used it as the entrance to the Pacific and terminus of their

overland journeys from the Gulf of Darien, which they generally accomplished in about ten days. Careful surveys were made in 1870 and 1871 by naval parties under Commander Selfridge, U. S. Navy, to ascertain the feasibility of a ship canal between this point and the Atlantic coast at Caledonia Bay and the Gulf of Darien, but the different routes across this part of the Isthmus were found to be quite impracticable. The route by way of the Atrato, the Napipi, and the Doguado rivers, considered by Commander Selfridge as the most practicable route eastward of Panama, terminates on the Pacific at Chiri-Chiri Bay, 112 miles below Garachiné Point.

"SAN LORENZO POINT lies 2 miles S.  $76^{\circ}$  E. from Brava Point, the shore between them receding in a shoal-water bight. A reef projects about 2 miles southeastward from the point, and on the reef at  $1\frac{1}{4}$  miles from the point are the Paul Rocks, above water.

"From San Lorenzo Point the shore line turns sharply northward and sweeps around in a semicircular curve to Pierce Point, a rocky projection 7 miles to the northeastward, forming within these points North Bay, in which the depths are quite regular from  $2\frac{3}{4}$  to 2 fathoms. A mud flat borders most of the shore and several streams enter the bay, among them being the rivers Congo and Cupunadi. In the western part of the bay is a shoal bank of triangular shape, about 3 miles on a side, with depths of one-half fathom, and on this bank are the islands Iguana and Iguanita and the Amelia islets and rocks. Lost Rock lies 2 miles north of San Lorenzo Point and one-fourth mile from shore.

"FROM PIERCE POINT a reef projects about three-fourths mile to the southward, with a rock above water near its outer end. McKinnon Bay, a small bight with shoal water at the head, lies eastward of the point and reef. Peris Point, 4 miles northeastward of Pierce Point, marks a sharp turn of the shore line to the northward at the beginning of the Boca Grande.

"GARACHINÉ POINT, the south entrance point of San Miguel Bay, is at the extremity of a peninsula projecting  $5\frac{1}{2}$  miles northward from the mainland, with an average breadth of 2 miles. The land to the southward and eastward of the peninsula is lofty, Mount Zapó—noticeable as a sharp conical peak about 5 miles from the coast—rising to an elevation of 3,000 feet above the sea. A high, bold, and wooded coast apparently free from dangers and with deep water close-to, extends

southward about 30 miles to Piñas Bay. Cape Escarpado, with a small bight just above it, open to the northwestward, lies about 3 miles southward of the point.

“Garachiné Point is clean, and on its north and west sides may be closely skirted, but on the east side the line of 3 fathoms runs eastward from the extreme point.

“GARACHINÉ OR SOUTH BAY, lying within Garachiné Point and Patena Point,  $11\frac{1}{2}$  miles to the northeastward, is shoal, with a low mangrove shore, from which mud banks extend to a distance of 3 miles. These flats are fronted by a shoal bank with 2 to 3 fathoms, occupying much of the remaining area of the bay. Several small streams enter the bay, and a channel with one-half fathom of water leads across the mud flat to the mouth of the River Sambu. Along the east side of the Garachiné Peninsula extends a tongue of water with a depth of  $2\frac{1}{2}$  fathoms, forming a small harbor with anchorage for small vessels near Garachiné village, a small collection of huts at the head, where enters the River Alquitran.

“Vessels may anchor close-off either Garachiné or Patena points, the depth of water being convenient.

“PATENA POINT is low, sharp, and projecting, with Pate-nito Islet close outside and deep water near islet and point. Colorado Point, about  $2\frac{1}{2}$  miles northeastward of Patena, is bold and rocky, with a conspicuous patch of reddish clay on its face; within the points the shore recedes about  $1\frac{1}{2}$  miles, forming Charles Bay. From Colorada to Corales Point,  $1\frac{1}{2}$  miles to the northeastward, the shore gradually gets lower, and from the latter point sweeps around to Virgin Point, forming a bay, with low mangrove shores, nearly 5 miles wide between the points; at the head is Corales village, about a mile southeast of the point, with anchorage off it at one-half mile; the shore of the bay is bordered by shoal water to the distance of three-eighths to three-fourths mile, outside of which are apparently no dangers.

“FROM VIRGIN POINT the shore line in its general trend turns gradually northward for nearly 5 miles to Virago Point, at the entrance of the Boca Chica; in this space are several little bays lined with mangrove, the points generally being of small elevation, rocky, and covered with bush. Bains Bluff, 1 mile southward of Virago Point, should be avoided on account of a ledge of rocks off it at 600 yards; the shore between the bluff and the point is also bordered by shoal water.

"CEDAR OR WASHINGTON ISLAND,  $3\frac{1}{4}$  miles northeast of Corales Point and  $1\frac{1}{2}$  miles west of Virgin Point, is about 600 yards long and wide and densely covered with wood. Several islets and rocks extend southward from it, and these, with the shoal extending from the opposite shore, take up much of the width of the channel on this side of the island. The best and most direct channel up the bay is northward of the island, and between it and Jones Islet, a conspicuous little rock about 20 feet high and covered with grass, lying  $1\frac{1}{4}$  miles to the northwestward of Cedar, both being clean and safe of approach, with 10 fathoms in mid-channel.

"STRAIN ISLAND,  $2\frac{1}{2}$  miles northeastward of Cedar and  $1\frac{1}{4}$  miles from the eastern shore, is about 25 feet high and covered with trees and shrubs. It is surrounded by a ledge of rocks, extending a short distance off it toward the channel, and is connected by mud banks with two islands westward of it.

Between Strain Island and the western shore are Jorey Island, a chain of islets called Los Gombales, Edith Islet, and Mary Islet, all forming a group within the 5-fathom line, covering an area of 2 miles by  $1\frac{1}{4}$  miles. Strain is the southeasternmost of the group and nearest the channel.

"ANCHORAGE.—The space included between Cedar, Jones, and this group of islets appears to afford the most favorable anchorage for vessels not wishing to enter Darien Harbor, or obliged to wait for the tide in order to do so on account of the strong tidal currents and eddies in the entrances.

"BARRY ROCK, seven-eighths mile southwest of Strain Island and three-eighths mile north of Seaford Point, is 20 feet high, covered with cactuses, and surrounded by deep water; the channel is between the rock and the island, and has a depth of 10 fathoms.

"STANLEY ISLAND, low and wooded,  $1\frac{1}{2}$  miles long by 1 mile wide, divides the channel into two passages, both leading into Darien Harbor; the principal one, the Boca Grande, forms a continuation of San Miguel Bay to the northward along the west and north sides of the island, while the Boca Chica skirts its south side, lying between the island and Virago Point.

"THE BOCA CHICA has on either side of its outer entrance a dangerous ledge of rocks, the passage between them being but about 200 yards wide; the southern ledge, called 'Colum-

bia Rocks,' projects about one-eighth mile westward from Virago Point and shows only at low-water spring tides; the Foley Rocks lie along the north side of the channel, extending nearly one-fourth mile westward from the south point of the island, and uncovering at half tide; north of this ledge is Trevan Islet. At three-eighths mile within the entrance the channel narrows to about 50 yards, the width between the shores being less than 200 yards. A small ledge makes out a short distance from Buena Vista, the southeast point of Stanley Island, having passed which the vessel will be in Darien Harbor, and may anchor, as convenient, in 5 to 10 fathoms, sand and mud.

"Although the Boca Chica carries a low-water depth of 5 fathoms, its use is not recommended, unless at slack water, for during the strength of the tide the velocity of the stream reaches 6 to 7 knots, and the eddies make steerage difficult.

"LEADING MARK.—The northwest extreme of Jorey Island and the middle of Mary Islet in line, S. 58° W. (S. 53° W. mag.), clears the rocks in the entrance of the Boca Chica. When past these rocks a vessel should keep in mid-channel, and when past the reef off Buenavista Point haul a little to the northward, to give Price Point a berth of 150 yards.

"THE BOCA GRANDE is a little over a mile wide at the entrance, between the rocks outside the Boca Chica and Milne Island, on the western shore, and continues for  $1\frac{1}{2}$  miles at about the same width between Stanley Island and the shore. A dangerous rock, only showing at about three-fourths ebb and connected by a ledge with the island, lies off its northwest point, and from the opposite shore a shoal extends five-eighths of a mile, leaving between rock and shoal a width of five-eighths of a mile for the navigable channel; this now bends to the eastward and continues of the same width between Ray and Jeannette islands on the north, and a large, flat rock, nearly always uncovered, and a small wooded island, about a cable off Stanley, on the south; then bending southeastward it continues between Ellen and Paley islands on the west and the main shore on the east into Darien Harbor, gradually broadening after passing the former island and attaining a width of nearly 2 miles abreast of the Boca Chica.

"SAVANNAH POINT is the southern extremity of the long, low peninsula separating for a distance of 5 miles the Savannah River from the Boca Grande. Foul ground borders the

point, extending off one-fourth mile, and at that distance south of the point is a small islet with deep water close along its southern edge. Graham Point, one-half mile beyond Savannah, marks the entrance of the river, and has close off it the tiny islet La Pantila.

“VAGUILA ROCK, showing at about half tide, lies a little over one-half mile south of Savannah Point. There is a good channel three-eighths mile wide between the rock and the islet off the point, with 9 to 11 fathoms of water.

“DIRECTIONS.—To pass through the Boca Grande: After passing Barry Rock a vessel may haul up for the southwest end of Stanley Island, keeping on the range of Barry Rock and Virgin Point until Jones Islet comes in range with Strain Island; then steer to pass about one-fourth mile from Milne Island, and as soon as Mary Island is shut in by Milne steer for Ray Island, keeping the east end of Edith Island a little open of Milne; following the channel, pass Ray at one-fourth mile, and as soon as Ellen Island opens from Turk Island haul to the southward, giving these islands and then Paley Island a berth of one-fourth mile to starboard, and anchor, as convenient, in 5 to 10 fathoms; bottom, sand and mud.

“DARIEN HARBOR, formed by the junction of the Tuyra and Savannah rivers, extends in a southeasterly direction from the Boca Grande to the village of Chipigana, on the south bank of the Tuyra, a distance of 11 miles, with a width of 4 miles in the northern part and 2 miles at the village. The depth of water is from 7 to 10 fathoms from Paley Island to the mouth of the Savannah, beyond which it shoals rapidly, almost the entire harbor having a uniform depth of from 13 to 17 feet. Off Chipigana there is a depth of  $3\frac{1}{2}$  fathoms for an area of about 1 mile by  $1\frac{1}{2}$  miles, affording excellent anchorage for vessels not exceeding that draft, to which it is accessible by taking advantage of the tides. During spring tides, which here rise 22 feet, the currents both of ebb and flood run at this point with great velocity, and especially is this the case during freshets, when it is oftentimes difficult for a vessel to remain at anchor.

“The shores of the harbor are almost a continuous line of mangrove, intersected by numerous small streams, with densely wooded hills from 100 to 300 feet high a short distance inland. Chipigana is a town of about 600 inhabitants, mostly negroes, of which race almost the whole population of

Darien is composed. The houses are built of bamboo, and everything is of the most primitive description, a compromise between barbarism and civilization.

“LA PALMA VILLAGE, on the west shore, just at the inner entrance to the Boca Grande and at the beginning of the shoal water of the harbor, appears to be situated at the best point, and has an abundance of fresh water.

“ANCHORAGE.—The best place for anchorage is in 7 to 10 fathoms off Palma Village, about a mile southeastward of Price Point and 600 yards from shore.

“TIDES.—High water, full and change, in Darien Harbor is at 4h. 15m.; the mean rise and fall of tide is 16 feet. The tidal streams in the narrows are very strong, especially at the time of springs, which are said to rise 24 feet. Great care is required in the navigation, and it would seem advisable, at least for a stranger, to wait for slack water before attempting the passages.

“PRODUCTIONS.—All tropical productions of the Western Hemisphere can be grown here. Maize, rice, sugar, coffee, cocoa, yams, and plantains grow almost wild; mahogany can be had in abundance; also the palm and the india-rubber tree abound. This fine harbor, with its extensive rivers penetrating into the interior, in the hands of an energetic people that would cultivate the fertile soil of the region, would soon become a place of importance.

“CLIMATE.—There is a rainy and a dry season, the former beginning in May and lasting until November, accompanied by lightning and thunder and winds peculiar to the Gulf of Panama; for the other six months of the year the weather is fine. With common care, the country is comparatively healthy.

“TUYRA RIVER, the Santa Maria of the Spaniards and buccaneers, rises in latitude 7° 40' N. and enters Darien Harbor near the village of Chipigana. About 26 miles above this village and a mile above the junction of the river Chucunaqua are the ruins of the old Spanish fort of Santa Maria, near which were the gold mines worked by the Spaniards in the seventeenth century. As far as Santa Maria, which is the head of navigation for all craft but canoes, the depths in the river are from 1 to 5 fathoms; above this point a steam launch drawing 3½ feet could go only during spring tides.

“The spring tides extend during the dry season to some 3

miles above Pinogana, which is 48 miles by river above Chipigana, but at this point the flood does not run more than two hours, with an extreme rise of 4 feet. During the neap tides the rise barely reaches Pinogana, and during the rainy season the influence of the tide extends but half the distance, owing to the great amount of water to be backed up.

“By following the bends a depth of 30 feet can be carried 20 miles above Chipigana, except at the crossings, where there is but 22 feet at ordinary high tide. Above this point the channel of the Tuyra narrows considerably and the depth decreases. The country as far up as Pinogana is flat and marshy a long distance back from the river and is overflowed during high water in the autumn.

“THE CANAL ROUTE by way of the Tuyra ascends this river some 40 miles above Pinogana, and then the Cué, a tributary from the eastward, to its source; thence it crosses the divide at an altitude of 753 feet above the sea and descends the Cacarica or the Peranchita to a junction with the Atrato, and then this magnificent, deep, and navigable river, some 40 miles, to the Gulf of Darien. The difficulties of this canal line of 55 miles, with its necessary tunnel of 2 miles, are such as to make it quite impracticable.

“CHUCUNAQUA RIVER, which joins the Tuyra from the north at a point 25 miles above Chipigana village, rises in latitude  $8^{\circ} 50' N.$ , westward of Caledonia Bay on the Atlantic; its course appears to have been the favorite track of the buccaneers from the Atlantic to the Pacific. Captains Coxon, Harris, and Sharp with 330 men in April, 1806, started from Golden Island in Caledonia Bay, and on the second day reached the head of this river, which they describe as so serpentine that they had to cross it every half mile, sometimes up to their knees, sometimes up to their middle, and as running with a very swift current. On the fifth day 70 of the men embarked in canoes, but found that mode of traveling quite as wearisome as marching, for at almost every furlong they were constrained to quit their boats to launch them over rocks, or over trees that had fallen athwart the river, and sometimes over necks of land. Early on the eighth day they reached Yavisa, which is 15 miles from Santa Maria, at the junction of the river of the same name, now the residence of the principal authorities of the province. Here they halted to prepare for the attack on the fort. They also made paddles

and oars to row with, for thus far down the river the canoes had been carried by the stream and guided by poles, but here the river was broad and deep. On the morning of the tenth day they attacked and carried the fort, but without gaining the expected amount of plunder, although a buccaneer says, 'We examined our prisoners severely.'

"SAVANNAH RIVER rises in latitude  $8^{\circ} 44'$  N. and a few miles from its source meets the river Loro, where the bottom is level with the half tide. Below this point for about 10 miles there is a general depth of  $1\frac{1}{2}$  fathoms, except in two places, where banks with only one-fourth fathom extend from shore to shore; thence to the mouth of the river, a distance of 12 miles, there is a good navigable channel with a least depth of  $3\frac{1}{4}$  fathoms, except for a stretch of  $1\frac{1}{4}$  miles with  $2\frac{1}{4}$  fathoms, just above the junction of the Rio Ingles. The navigable entrance is about three-fourths mile wide between Graham Point and Haydon Bank, the channel narrowing within to about three-eighths mile. The shores of the river are low mangrove land, skirted with hills 200 to 300 feet high, within 2 miles of the banks. H. M. S. *Virago* anchored in  $3\frac{1}{2}$  fathoms, 1 mile northeast of Graham Point.

"THE DARIEN CANAL ROUTE, so called, as surveyed by Commander Selfridge, U. S. Navy, in 1870 and 1871, ascends the Savannah River 24 miles to the junction of the Loro, and then the latter to its source; thence it crosses a ridge and descends the La Paz to the Chucunaqua, crosses the latter, and ascends to its source, the Sucubdi, a tributary from the east; thence it crosses the divide at about 4 miles from the Atlantic coast, with an elevation of 1,003 or 1,259 feet, and descends to Caledonia Bay by either the river Aglaseniqua or the Caledon.

"A variation of this route, starting from the junction of the La Paz with the Chucunaqua, ascends the latter some miles to the Morti, and this river to the divide, with here an elevation of 1,137 feet, descending thence to Caledonia Bay by the river Sasardi.

"A canal by way of the Sucubdi would require a tunnel 10 miles long to connect the elevation of 160 feet on the Atlantic slope with a corresponding height on the Pacific slope; in addition there would be an average cutting of 130 feet for 10 miles or more, and the Chucunaqua to be crossed by a costly aqueduct. The route by way of the Sasardi and Morti presents results of the same character and no less unfavor-

able. The impracticability of the Darien route was considered by Commander Selfridge as fully established.

"By the report of the Isthmian Canal Commission the Salsardi route would require a tunnel 1.6 miles long, assuming an open cut to be used to a depth of 400 feet; and if the Aglaseniqua or the Caledon were used the tunnel would be about 2 miles longer, while the approaches on the south side would be much heavier. The total length of canal navigation from Caledonia Bay to the mouth of the Savannah River would be about 50 statute miles.

"SAN JOSÉ BANK, a dangerous shoal in the center of which is the Trollope Rock with only 2 feet of water on it, lies in the fairway of vessels bound to Panama from the southward, the rock being 15 miles N. 88° W. from Garachiné Point and 10 miles S. 62° E. of Galera Island, the southeasternmost of the Pearl Islands. The bank is 1 mile in diameter within the 5-fathom line and  $2\frac{3}{4}$  miles long by 2 miles wide within the 10-fathom line, outside of which the water deepens in general quickly; close to the rock are  $2\frac{3}{4}$ ,  $3\frac{1}{4}$ , and 4 fathoms. Vessels should not approach within the depth of 10 fathoms.

"MARKS.—The Trollope Rock may be easily avoided, either by keeping along the main shore until past Garachiné Point, or by passing about 2 miles from Galera Island, with care for the shoal patch and rocks off its southern side.

#### THE PEARL ISLANDS.

"THE PEARL ISLANDS, also known as *Islas del Rey*, *Islas del Istmo*, and *Islas de Colombia*, form an archipelago consisting of 16 islands and numerous rocks, covering an area of 450 square miles on the eastern side of Panama Gulf, the northern extremity being 33 miles southeastward of Panama city and 15 miles from the nearest part of the mainland. Rey Island is the largest of the group; San José, Pedro Gonzales, Bayoneta, Casaya, Saboga, Pacheca, and Contadora are of secondary and the rest of minor importance. Scattered among these islands are numerous fishing villages, containing 1,941 inhabitants in 1843, chiefly engaged in the pearl fishery, which formerly produced about 2 gallons of pearls a year. The pearl shells gathered here, also an article of commerce, are known as Panama or Bullock shells, and are shipped to San Francisco or Panama in barrels.

"These islands are low and wooded; the soil is fertile but

not much cultivated. The numerous cocoanut groves and bright sandy beaches, interspersed with small rocky bluffs crowned with trees, give them a pleasing appearance.

"**SABOGA ANCHORAGE.**—This good and spacious harbor, about 2 miles long, north and south, and nearly 1 mile wide, with an average depth of 9 fathoms, lying at the extreme northern end of the archipelago, is formed by three islands and numerous islets and shoals. Saboga, the largest island,  $1\frac{1}{2}$  miles long by an average width of one-half mile, is on the southwestern side. From its northern end a reef and shoal extend  $1\frac{1}{2}$  miles to the northward, protecting the harbor on the west. Contadora Island,  $1\frac{1}{2}$  miles long and one-half mile wide, forms the southeastern side; and Pacheca Island, three-fourths mile long and one-half mile wide, the northern side. About midway between these two islands is Bartholomew Islet, north and south from which extend shoals, protecting the harbor on the east side.

"**CHANNELS.**—Three channels lead into the harbor, respectively from the northwest, the east, and the south. The Pacheca Channel, southward of this island, is nearly one-half mile wide and appears to carry a depth of not less than  $5\frac{1}{2}$  fathoms in a straight course, but should be more closely examined, as there is a deficiency of soundings. Bartholomew Islet, on a bearing S.  $66^{\circ}$  E. (S.  $71^{\circ}$  E. mag.), leads through in about mid-channel. Contadora, northward of the island, is at present the deepest and safest channel, carrying a least depth of 9 fathoms by keeping the north end of Saboga just open of the south end of Near Islet, S.  $85^{\circ}$  W. (S.  $80^{\circ}$  W. mag.). Saboga Channel, between this and Contadora, appears to have a 5-fathom channel, but must be navigated with caution, and is not recommended before further examination on account of the shoals obstructing the entrance and reported shoal patches outside. If this harbor were to be much used a few buoys would greatly assist the navigation.

"A considerable village with a church lies on the northeast shore of Saboga Island, at the head of a bay filled with a shoal and a reef. The usual anchorage is in 7 or 8 fathoms at one-half mile off this village. Contadora has 5 fathoms close along its northwest shore, which is low and well adapted for wharves.

"**TIDES.**—High water, full and change, at Saboga anchorage is at 4h. 0m.; springs rise about 14 feet.

“CHAPERERA AND PAJAROS, the next islands to the southward of Contadora, have a 4-fathom channel between them, but it should not be used, as the ground is foul. A  $2\frac{1}{4}$ -fathom shoal lies three-fourths of a mile eastward of Pajaros, and southward of this island the soundings are very irregular, with rocky bottom. No vessels should attempt the passages between Pajaros and Rey islands without previous examination and marking the points of the shoals.

“CASAYA, BAYONETA, AND VIVEROS are the largest of a cluster of islands on what may be termed an extensive reef, about 8 miles long by 5 miles broad, stretching off the northwest point of Rey Island. There are also numerous islets and rocks rising from the reef, and the passages between them all are foul, with occasional strong tides. A bank  $1\frac{1}{2}$  miles long by three-fourths mile wide, with only 9 feet of water on its shoalest part, lies nearly 4 miles eastward of the north point of Casaya, and the Caracoles and Cangrejo islets, with foul ground around them, lie about 2 miles off the northeast point of Viveros.

“CLEARING MARKS.—The entire group of islands stretching northwestward from the northwest point of Rey Island should be avoided by Panama-bound vessels, which should not approach the islands on their western side nearer than just to open the eastern point of San José eastward of Pedro Gonzales Island, bearing S.  $6^{\circ}$  E. (S.  $11^{\circ}$  E. mag.), and on their eastern side should not open San Pablo, an islet off the northeast side of Rey Island, or bring it to bear eastward of S.  $31^{\circ}$  E. (S.  $36^{\circ}$  E. mag.).

“REY ISLAND, the largest of the Pearl group, is about 15 miles long, north and south, by 7 miles wide, with several peaks, the highest being 600 feet high. Numerous islets and shoal patches, with deep water between them, lie 3 miles off the western shore, but should not be approached by strangers within the depth of 10 fathoms. Cocos Point, the south extreme, is the end of a remarkable promontory, 4 miles long by about 1 mile wide, jutting southward into the sea. Its extreme cliff was crowned in 1859 by an umbrella-like tree, making it conspicuous.

“Off the eastern shore of Rey are also islands, but they are steep-to and may be approached within one-half mile, with the exception of Cañas Island, off which is a 3-fathom patch lying outside a sunken rock, nearly  $1\frac{1}{2}$  miles from the shore. This

may be easily avoided by not opening Monge Islet eastward of St. Elmo Island until Pablo Islet opens eastward of Muerta, a small barren islet lying about 1 mile northward of this patch.

"ST. ELMO BAY, on the east side of Cocos Point, is open to the southeastward, but has convenient anchorage in all parts, in 6 to 9 fathoms, and a good stream of water near Lemon Point at its head.

"SAN MIGUEL, the principal town of these islands, is on the north side of Rey. It is of considerable size, with a conspicuous church, but is badly situated, landing at low water being difficult. Cerro Congo and Cerro Vali rise southward of the town, the former being 481 feet high. Supplies are uncertain and dear, all productions of the island being generally sent to Panama.

"ANCHORAGE.—Vessels having to lie off the town should run in between Caracoles and Cangrejo islets, taking care not to shoal the water under 7 fathoms at low water and using caution in the approach, as the bottom is irregular and rocks abound; anchor in about 6 or 7 fathoms when the church is shut in, or behind Afuera, an islet lying off the town, bearing S. 29° E. (S. 34° E. mag.).

"GALERA ISLAND, lying 8 miles S. 81° E. from Cocos Point, is small, and, like the point, remarkable for its umbrella tree. A cliff forms its southern side, sloping down to a beach on the north, and to the southward a reef runs off for nearly 1 mile. This island is generally the first land made by vessels bound to Panama; it should not be approached within the depth of 10 fathoms, but between it and Cocos Point there is a good passage by using which the vessel will be clear of the San José Bank, 10 miles to the southeastward.

"PEDRO GONZALES ISLAND, separated from the islets off the west side of Rey by a broad, deep channel, is of irregular shape, with an extreme length, northwest and southeast, of  $3\frac{3}{4}$  miles by an average width of one-half mile, and has on its northern side a wide and deep indentation forming two bays, Perry and Magicienne, partially protected on the north by the small islands Señora and Señorita. Trapiche Island, 100 feet high, which is connected by a sandy neck with Gonzales at low-water springs, forms the division between the two bays. Off the east point of Trapiche extends a rocky ledge, and from this extends a shoal with 14 feet of water at the end,

nearly 600 yards from the point. Perry Bay, which lies within this shoal and Swift Point on the opposite side, is a milé wide and penetrates nearly a mile, affording anchorage in 5 to 7 fathoms, with good protection from wind and sea.

"A large stream of water, found in full force in the month of April at the end of what had been considered a remarkably dry season, runs into the sea on the western side of Magicienne Bay. This bay, however, is small and shoal, having only a tongue of deep water,  $3\frac{1}{2}$  fathoms, projecting three-eighths mile within the entrance, with a width of one-eighth mile. Señora, wooded and 70 feet high, and Señorita, small and 40 feet high, with the shoals off their eastern sides, have an extent of about 1 mile, and are separated from Trapiche by a 7-fathom channel, steep-to on both sides.

"Perry and Magicienne bays were examined in 1858 as to their capabilities for a depot for steam vessels. Although not considered so good and not so near Panama as Saboga anchorage, they were thought to have some advantages.

"TIDES.—High water, full and change, in Perry Bay is at 3h. 50m.; rise, 16 feet. The tidal streams are not felt at the anchorage, but off the island there is a considerable set, the flood running northward and the ebb southward, the latter being generally the stronger.

"DIRECTIONS.—Vessels may pass on either side of Señora and Señorita Islands, taking care to avoid the shoal eastward of them, if passing on that side, by keeping the eastern point of Gonzales Island, a rocky peninsula, open of the point next north of it, bearing S.  $17^{\circ}$  E. (S.  $22^{\circ}$  E. mag.) until Punta Piloto, 120 feet high, the north extreme of Gonzales, bears to the westward of S.  $73^{\circ}$  W. (S.  $68^{\circ}$  W. mag.); if entering Perry Bay, the shoal off Trapiche may be avoided by not passing westward of midway between this island and Swift Point.

"SAN JOSÉ ISLAND, lying 4 miles south of Gonzales, is about  $6\frac{1}{2}$  miles long by 3 miles wide, and its summit forms a tableland said to be a considerable grazing ground. Nearly 2 miles southeast from Iguana Point, the north extreme of the island, a large waterfall, running into the sea, affords an excellent watering place. A deep bay indents the southeast side of the island, but the swell sets in there with great violence. Off the southern end are a number of high rocks of singular and fantastic shapes, also lashed by a heavy surf; this part of the island should be avoided. The western shore

is bold and clifty, with a small bay near the middle, opening to the northwestward.

"THE CHANNEL,  $6\frac{1}{2}$  miles wide, between Rey and San José, is foul on the Rey side, but deep and clear on the San José side, the depths exceeding 20 fathoms for two-thirds the length of the island.

"PASSAGE ROCK.—This dangerous sunken rock, with 12 and 9 fathoms close around it, lies near the middle of the channel, otherwise deep and clear, between San José and Gonzales islands.

"CLEARING MARKS.—The peak next south of the highest on Rey Island, just open south of Coco Islet, one of the outlying islets off the west side of Rey, bearing N.  $78^{\circ}$  E. (N.  $73^{\circ}$  E. mag.), leads more than one-half mile southward of Passage Rock; vessels should keep between this line and the San José shore.

"BOUND TO PANAMA.—Vessels bound to Panama from the northward should make the island of Jicaron, which lies about 50 miles westward of Mariato Point, and from here endeavor to keep under the land as far as Cape Mala, or, if unable to do this, push across for the opposite coast, where the current will be in their favor. On getting to the eastward of Cape Mala, the safest plan is to shape a course for Galera Island and use the eastern passage, that between the Pearl Islands and the main; if, however, tempted up the gulf by a fair wind, vessels should endeavor to get on the western coast of the Pearl Islands, for the reasons noted below.

"The passage from the southward into the Gulf of Panama is easily made during the greater part of the year by keeping about 60 miles from the coast north of Guayaquil, and after crossing the line shaping a course for Galera Island, taking care, especially in the dry season, to stand inshore with the first northerly wind. By so doing vessels will most probably have the current in their favor along the coast, whereas by keeping in the middle or on the western side of the gulf a strong southerly set will be experienced. After making Galera and clearing the San José Bank the navigation between the Pearl Islands and the main is clear and easy, with the advantage of being able to anchor should the wind fail or the tide be unfavorable. As a rule this passage should be taken, but with a strong southerly wind the navigator is tempted to run up the bay, in which case he should keep on

the western shore of the Pearl Islands, where less current will be found, and anchorage should the wind fail, an event always to be expected in these regions. Between Chirambira Point and Cape Corrientes the land is low and faced with shoals, caused by the numerous rivers that have their outlets on this part of the coast; but after passing Cape Corrientes it may be approached fairly close except off Solano Point, where some rocky shoal patches extend seaward, as the coast is in general bold-to. Care, however, should be taken not to run into the calms caused by the high land, as it is difficult to get off into the breeze again, and the swell sets inshore, where there may be no anchorage until close to the rocks.

“In beating up the Gulf of Panama in the fine season, the eastern passage is to be preferred, as, with one exception, it is free from dangers, the water is smooth, and a regular tide enables more northing to be made than would be possible in most cases against the strong current and short high sea which at this season prevail in the middle or on the western side of the gulf. During the rainy season a straight course up the bay is preferable to becoming entangled with the islands, the current generally following the direction of the wind.

“BOUND FROM PANAMA.—The great difficulty, however, is the passage out from Panama Bay. Pizarro, the first to attempt this, in November, 1525, after beating about for seventy days, was forced to return to the river Chiman.

“The best plan for all sailing vessels, whether bound for ports north or south of Panama, is to push to the southward and gain the southeast trade. By so doing they will not only avoid the doldrums and vexatious winds, but will have the additional advantage of salubrious weather, with the sea at a temperature of 75° instead of 83° F. Between January and April it may be better for north-bound vessels to cross the line between the Galapagos Islands and the coast before pushing westward, keeping south of the line until westward of 105° W., when a course may be shaped for 10° N. and 120° W., in which track they will probably find the northern trade. This will generally prove far preferable to encountering the vexatious weather met with at this season north of the Galapagos.

“The passage to the northward has been made by keeping

close inshore after passing Cape Mala, and navigating by the land and sea breezes; but this should be attempted only by vessels that are well found and manned, unless bound to the ports of Central America, when it is their only route.

"The passage to the westward during the rainy season is a most tedious affair. Calms, squalls, contrary winds and currents, a heavy swell, and extreme heat, as well as an atmosphere laden with moisture and rain, are the daily accompaniments. It often occurs that 20 miles of westing are not made in a week, and it is only by the industrious use of every squall and slant of wind that the passage can be made.

"In the navigation of these regions and of the coasts of Central America and Mexico even small auxiliary steam power proves most useful."—*West Coasts of Mexico and Central America. Hydrographic Office, No. 84, 1902.*

"ISLANDS, ETC.—There are on the coast and on the banks of rivers marshes or ponds more or less permanent and extensive.

"Both the Atlantic and the Pacific coasts are sprinkled with islands, in some spots so thickly grouped as to constitute archipelagoes.

"On the Atlantic side there are some 630 islands and islets, with an aggregate area of 147 square miles, of which about 115 square miles are susceptible of utilization for lumbering or colonization. The remainder is waste, unsheltered, and lacks both water and vegetation.

"The islands of this Department on the Pacific coast are larger and more numerous than those on the Atlantic side. In the group known as the Archipelago de las Perlas the principal island is that of San Miguel, which is about 16 miles long by 7 or 8 miles wide. The largest island on the coast is that of Coiba, a few miles from Bahia Honda, whose greatest length is some 22 miles and its greatest breadth is 15 miles. These Pacific islands are said to number in all 1,053, with an aggregate area of about 500 square miles."—*Handbook of Colombia, Bureau of American Republics.*

"Between Saboga and Bartoleme islands, in the north part of Perlas Archipelago and about 40 miles southeast of the city of Panama, is a fine anchorage for a fleet of at least 10 large vessels."—*Report of Capt. C. B. Humphrey, Twenty-second Infantry, 1903.*

PORTS, BREAKWATERS, ETC.—*Colon.*—"Colon is located on

a flat island in the bay of Limon. The main harbor is located on the west side of the city. On Point Toro, opposite Colon, is located a strong light, about 75 feet high, which can be seen for about 20 miles at sea. On the point of the island, in the city of Colon, is also located another light, about 30 feet in height, which can be seen at least 12 miles at sea.

"There is also another bay on the east side of the city of Colon. The largest ships may anchor in either one of these bays. All along the water front of Colon are located ships' piers. In case of storms coming from the north ships must leave the harbor and also the docks and proceed to Portobelo for protection. There is a plan proposed to build a break-water at Colon, at a cost of about \$1,500,000, to protect the harbor. This is quite practicable and would render the harbor safe. Of the two ports, Portobelo is very much the better, but no land communication is to be had with Colon except by a trail.

"No timber exists in the vicinity of Colon, yet a small amount of large pine timber could be found in the railroad yards.

"Small boats could be landed along the shore about one-half mile south of the wharves. The anchorage in the harbor off Colon is sufficiently large for almost any number of vessels."—*Report of Capt. C. B. Humphrey, Twenty-second Infantry, 1903.*

"The harbor of Colon is not by any means a safe one, as it is without natural or artificial protection, and during the 'norther' season—January, February, and March—vessels are in danger of heavy damages. The wharves here, which are owned and controlled by the Panama Railroad Company, are five in number. Four of them are modern steel and iron structures and afford ample room to berth twelve ocean-going steamers and a number of smaller sailing craft. The harbor entrance and the wharf slips have recently been dredged, so that vessels of 28 feet draft may be safely docked."—*Commercial relations of the United States with foreign countries during the year 1900.*

*Panama.*—"Ships which do not enter the harbor of Panama northeast of the city or the harbor of La Boca may find anchorage on the north side of Culebra Island, where there is located a small town. There are three lighters owned by the English company, which run from their pier at La Boca to the island of Culebra. Anchorage may also be found for

ships on the northeast side of the island of Taboga. Taboga is a very rich and productive island, where the principal fruits are grown, such as mangoes, pineapples, and bananas. This island is also generally in a very good sanitary condition, and in case of an epidemic of yellow fever, smallpox, or bubonic plague on the Isthmus the richer inhabitants of Panama leave for this island."—*Report of Capt. C. B. Humphrey, Twenty-second Infantry, 1903.*

"Every steamer or sailing vessel of high freeboard upon arriving in port casts anchor to the north of the Flamenco, Perico, and Naos islands, which are situated  $2\frac{1}{2}$  miles south of Panama. The passengers are carried to the wharf of the Panama Railway Company when the state of the sea permits it, as well as the cargo, which is unloaded in large scows of 120 to 300 tons each. The same is done in embarking passengers and cargo. For this service there are at Panama three good-sized strong tugboats, called as follows: *Bolívar*, *Ancón* (which is kept at anchor and in reserve), and *Morro*.

"The two former belong to the Panama Railroad Company and the latter to the Pacific Steam Navigation Company.

"It is very easy to obtain coal and water in this bay, as the aforementioned companies furnish it to all who ask for it.

"This bay also has a cistern boat (steamer) called *Isabal*, and owned by the Pacific Mail Steamship Company. It has a capacity of 47,000 gallons of fresh water.

"In order to ply the waters of the Bay of Panama it is necessary to use tide tables, which can be had in the printing office of *La Estrella de Panamá*, where they have been published for years, and are compiled by seamen who are well acquainted with the bay.

"Between the wall or bastion of Chiriqui, which is situated to the east, and the northeast coast the sea runs in a considerable distance, forming an excellent roadstead, at the head of which are situated the public market of the city and four large wharves—that of the market, where the coasting trade is carried on; the American wharf, alongside which come the tugboats and bongos, and where the products in transit or brought for Panama from the Pacific coast are loaded and unloaded; the English wharf of the Panama Railroad, where the Pacific Steam Navigation Company transacts its business, and the coal wharf, where this combustible is loaded in order to transport it to Flamenco.

"The constant movement in this excellent roadstead of hundreds of caiques, scows, sloops, schooners, and tugboats which are continually entering and leaving, mostly with unfurled sails, together with the noise caused by the engines and cars of the railroad and by the carriages and wagons which arrive in considerable numbers from the center of the city and leave from the market and wharves, lend this place the lively aspect and air of greatness peculiar to all busy ports.

"Panama at high tide, and seen from seaward, is beautiful and looks like a European port."—*Directory of Panama, 1898.*

"*La Boca.*—Mr. Francis Gudger, vice-consul general of the United States at Panama, has furnished a description of the wharf at La Boca. This wharf was built by the Panama Canal Company, but is now controlled by the Panama Railroad Company. The rates charged for vessels coming alongside are governed for the most part by contract.

"The wharf, constructed wholly of steel, with a roof and sides of corrugated iron, is situated at the mouth of the Panama end of the Panama Canal, about  $2\frac{1}{2}$  miles from Panama City. During its construction its failure was predicted on account of the great rise and fall of the tide; also because of the difficulty of keeping the channel leading to the wharf open, as a great amount of mud is brought down by the San Juan River. The difficulties have been reduced to a minimum. Vessels are not lashed alongside the wharf, but have floats placed between them and the wharf, so that there are no bad results from the tide. The cranes or winches on the wharf are of a special kind that permit of working the cargo at all stages of the tide. The following measurements will give an idea of the size and capacity of the wharf:

Total length.....	feet..	985
Total width.....	do ..	54
Depth of channel alongside at high tide.....	do ..	$45\frac{1}{2}$
Depth of channel alongside at low tide.....	do ..	$26\frac{1}{2}$
Width of channel alongside .....	do ..	98
Cranes (six of 2 tons each, one of 20 to 24 tons).....	number..	7
Capacity of vessel space .....	feet..	985
Tonnage of largest vessel yet docked.....	tons..	4,600
Railroad tracks on wharf .....	number..	2
Car capacity of tracks on wharf .....	cars..	39

"It is possible to dock any vessel drawing less than 26 feet 6 inches.

"In speaking of the channel alongside it might be well to explain that this is not exactly a channel, but what is called a souille, or basin, in which the vessels lie, and in which there is a maneuvering space, at any stage of the tide, of 486 feet. The bottom of this basin is soft mud, yet, while it is considered best for the vessels to be at all times afloat, they can rest easy in the muddy bottom. From the above it is seen that any vessel of 500 feet length and not drawing more than 26 feet can be handled at this wharf with facility."—*Monthly Bulletin of the Bureau of American Republics, August, 1901.*

"A branch of the Panama road runs from the city of Panama through the town of La Boca to a large ships' pier in La Boca Harbor.

"It contains facilities for docking 3 large ships at the same time. There are 16 steam cranes and 4 electric cranes on the dock. On the end of the pier is a large 20-ton crane. The rise and fall of the tide is over 20 feet, but owing to the dredging which goes on all the time ships can come in at any stage of the tide.

"Across the Rio Grande from the town of La Boca, about 700 yards away, can be seen the mouth of the south entrance to the canal. The harbor at La Boca and the harbor of Panama might be commanded perfectly by artillery placed upon the hills between the two places. La Boca is also commanded by a hill to the east, shown in the charts, about 1,000 yards away. There is a first-class wagon road between Panama and La Boca."—*Report of Capt. C. B. Humphrey, Twenty-second Infantry, 1903.*

"*Various Ports, etc.*—For traveling to any points in the interior of the Department, except those between Panama and Colon, although there are a few bridle paths, the most convenient, cheapest, and shortest routes are by sea or rivers.

"To the west of the city of Panama are situated the most populous and richest provinces of the Department, for, although Darien, which is situated to the east, possesses such great and varied natural riches that they will without doubt render it an emporium when its day arrives, they are not yet under exploitation, with the exception of the rich gold mines of Espiritu Santo and Cana.

"To the west are situated the provinces of Coelé, Veraguas, Los Santos, and Chiriquí, and to the northwest the flourishing district of Bocas del Toro, belonging to the province of Colon.

"Travelers may reach these points as follows: From Colon to Bocas del Toro in steamers or in some of the sailing or steam vessels which are engaged in the banana traffic.

"The provinces of Coclé, Veraguas, Los Santos, and Chiriquí have their harbors on the Pacific or on some of the rivers which empty therein and are navigable for minor craft and sailing vessels. Traffic between Panama and these provinces is carried on in greater part by sailing vessels, except that to Chiriquí Province, where, at Port David, steamers touch with considerable frequency, because of the growing commerce of that province with and its proximity to the Republic of Costa Rica.

"The province of Coclé has several harbors, but that of Aguadulce is the one preferred, because steamers visit it also. The city of Penonomé, capital of the province, has for its service the harbor of Posada on the river Coclé. The port of Aguadulce will not, however, lose its prestige, and it will certainly always be preferred by travelers bound for the towns in the province mentioned (Nata, Anton, Penonomé, etc.), and even for the contiguous provinces of Los Santos and Veraguas, owing to the advantageous circumstance that, as before stated, steamers and large sailing vessels touch there.

"The province of Veraguas has the harbors of Montijo and Sona on the rivers San Pedro and San Pablo, which empty into the Gulf of Montijo and are navigable in their headwaters with minor craft and sailing vessels. But since, in order to go from Panama to these harbors, it is necessary to double the peninsula of Azuero, the port of Aguadulce is preferable in going to Santiago (capital of the province). From this port (Aguadulce) the traveler goes to Santiago by a good wagon road. There are over a hundred wagons at Aguadulce to attend constantly to the transportation of passengers and freight.

"The port of Aguadulce, after those of Panama, Colon, Bocas del Toro, and Pedregal, is the most frequented and visited by steamers. This port is situated in the Gulf of Parita, which forms part of the great Gulf of Panama, and it is owing to this advantageous position that it serves as a stopping place for steamers and sailing vessels.

"From the maritime salt works owned and operated by the National Government at Aguadulce almost all the towns in the department are supplied with salt.

"The province of Los Santos, which is situated on the peninsula of Azuero, possesses many commodious maritime ports, the principal of which are Chitré, Las Tablas, and Monsabé.

"The Pacific Steam Navigation Company dispatches one or two steamers every month from Panama, which stop at Aguadulce, Remolino, San Lorenzo (when necessary), Sona, Pedregal, and Puntarenas (Costa Rica).

"For voyages to the archipelago de las Perlas and to Darien they put into service coast-trading vessels, which enter and ascend the Tuira, a river of great volume and navigable by steam as far as Yavisa. The Darien Gold Mining Company dispatches regularly a steamer to the port of Yavisa.

"The fares on the sailing vessels to these ports are as a rule very reasonable, varying from \$2 to \$5 per person, according to the class in which the passenger wishes to travel."—*Directory of Panama, 1898.*

**TIDES.**—"The tides vary considerably with the seasons, and are much higher at Panama than at Colon. In Colon Bay the difference between ebb and flow seldom exceeds 12 or 14 inches, and is often scarcely perceptible for days together, whereas in Panama Bay it is as much as 8 feet in the early summer (May and June), when it is least felt, and rises to 20 or even 23 feet in winter, the average for the year being 13 or 14 feet—that is, as many feet as inches on the opposite side. The consequence is that in an open canal without locks no equilibrium could be established, the current constantly shifting with the alternating tidal currents."—*Stanford's Compendium of Geography, Central and South America.*

(d) **CITIES.**

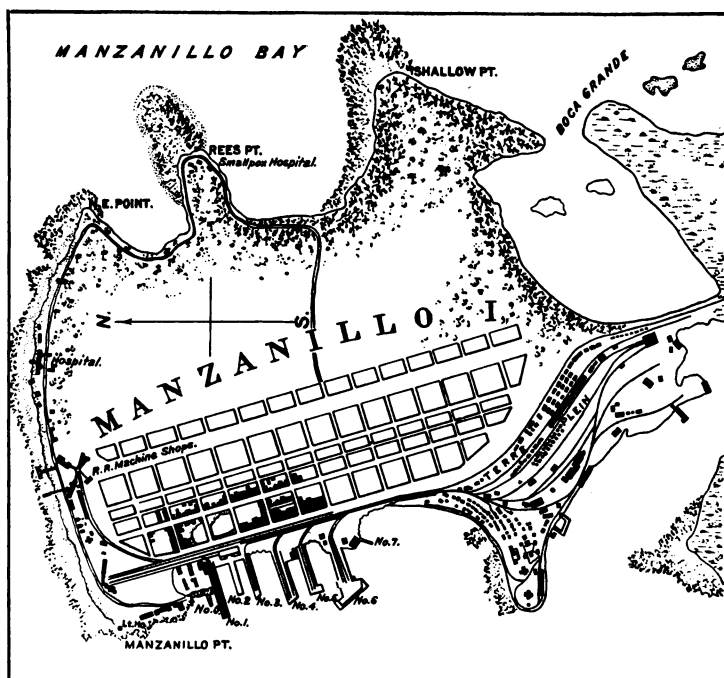
**Colon.**—"Under the old régime of Spain the only line of communication between the two oceans was one simple mule path crossing the Isthmus from Panama to Porto Bello, on the Atlantic side. Porto Bello Harbor is commodious and deep, but the fortifications of the old seaport are now overgrown with forest vegetation and the place has become an obscure hamlet, occupied by a few hundred negroes, who do a little trade with Colon, Colombia, and Jamaica.

"The deadly Chagres fever raged so there that the port was practically abandoned, and Chagres became the Atlantic

terminus of the isthmian route from Panama. But Chagres soon won fame as a hotbed of marsh fevers and the population rapidly disappeared.

"A new port was founded, therefore, which was called Colon, in honor of Columbus, who discovered the bay. It became known also as Aspinwall, from the name of one of the chief promoters of the isthmian railroad. This name in late years has been very little used.

"After Colon was burned in the revolution of 1885 it was



COLON.

rebuilt on a larger plan and on better-drained ground, but it is still a very unhealthy place."—*New York Sun*, November 15, 1903.

"The city of Colon has a population of about 13,000. The mean temperature is 80.6° F. The air is most oppressive and saturated with moisture. The city is generally composed of miserable frame houses and small stores. At the mouth of the canal is a fine statue of Columbus, and near it are grouped the houses of the old French company, now unoccupied, but still in a fair state of repair. Two of these were

once handsome—the houses of M. de Lesseps and his son. At the other end of the city is the large hotel owned by the railroad company and about it are grouped many comfortable houses belonging to foreigners. The other chief buildings are the stations and storehouses of the railroad and steamship companies. These could be used as excellent barracks for troops to the number of 1,200.

“A great many supplies, such as canned goods, could be obtained in Colon. There is a hotel in Colon, run on the American plan, which will accommodate about 100 to 150 people. The best drinking water obtainable is from the cisterns. Supplies of all kinds could be transported across the Isthmus by the railroad.

“The buildings which might be used as barracks for troops have already been mentioned. Near Colon there are really no suitable locations for camps, the country being generally too swampy about the city. The climate is hot. The rainfall during the rainy season is very heavy.

“Troops should not be landed from ships in Colon for any length of time before operations were to begin. It would be preferable to keep them aboard ship. The sanitary condition of Colon could be very much improved. At present it is very bad.

“There is an old frame building, covered with galvanized iron, two stories in height, above 50 by 70 feet, along the railroad in the southern part of the town which was used as a railroad station, but it is now occupied by about 75 Colombian troops.

“The population of Colon is made up of a few Americans, who have small stores, quite a number of French, who have general merchandise establishments, and a few Jews, who are money changers and pawnbrokers. The negro population are generally English subjects and come from the island of Jamaica.

“The railroad trains all have good, energetic American conductors and engineers.

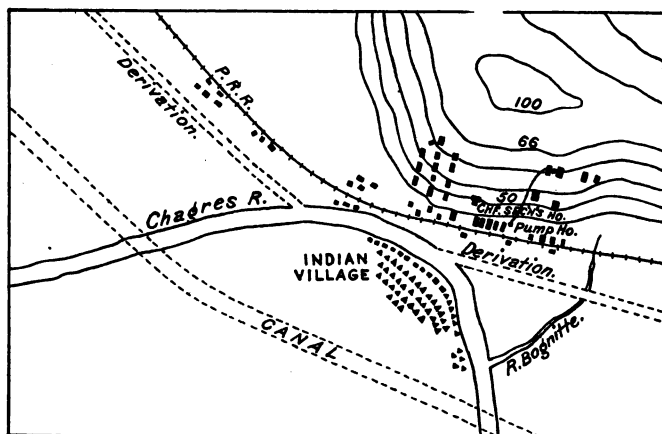
“Coal for ships and for the use of the railroad company is shipped from Norfolk, Va., generally. The railroad company generally keeps a supply of about 500 tons. The maximum rise and fall of the tide at Colon is 2 feet.”—*Report of Capt. C. B. Humphrey, Twenty-second Infantry, 1903.*

“At Colon is the ice plant of the Panama Railway Company. The output is about 35 tons monthly. Its capacity is

2 tons per twenty-four hours. The ice is sold at the rate of 1 cent per pound gold, but only to employees of the railroad."—*Commercial Relations, 1898 and 1902.*

"There are ample quarters; best near light-house or on terreplein. Hospital accommodation, 500; water supply, fair. Principal water supply from Frijoles or Monkey Hill. All water should be boiled before use. Ample stores. Telegraph cable to Jamaica lands over the reef at a hut with shed roof near light-house. Landing best made at wharves or to leeward of terreplein. As a rule wharves have no steps or derricks; No. 7 is an exception; artillery may land on it. Landing may be made by a limited number of boats in a bight on eastern shore, near Rees Point; it should be approached with caution. A cart road leads from this point across to town, entering it abreast of Pacific Mail Steamship wharf. Landing can also be made from Limon Bay upon canal, between kilometer 3 and 4. The beach here is hard; no surf. The causeway and wharves should be guarded. Numerous tugs, steam launches, and barges belong to canal. Dry dock near canal entrance. The Chagres is navigable for boats up to Gatun.

"*Buhio Soldado.*—Sixteen miles from Colon; 215 frame houses, 120 huts. Small machine shop. Springs of fairly good water near railroad station. Telegra. ....



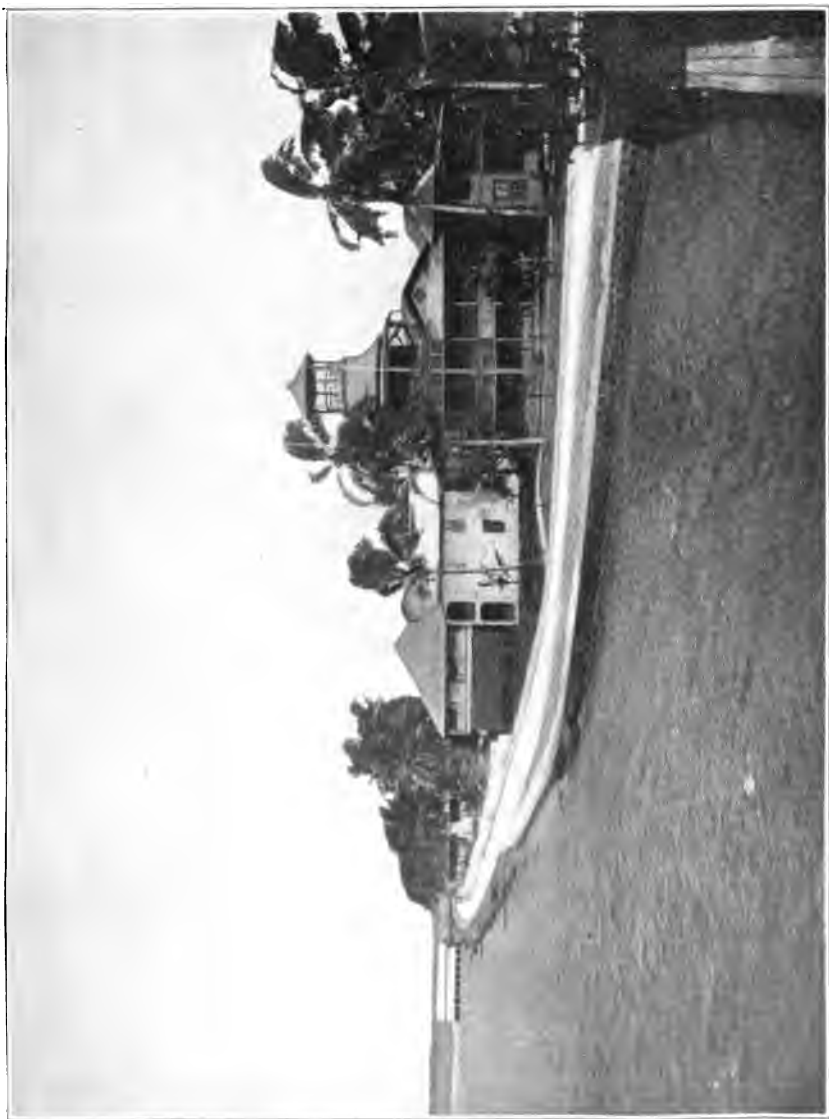
GATUN.

"*Gatun.*—Seven and one-fourth miles from Colon. Canal village on east bank of Chagres; Indian village on west bank. Communication with Aspinwall by canal, railway, or Chagres;



COLON. CHRISTOPHER COLUMBUS AVENUE.



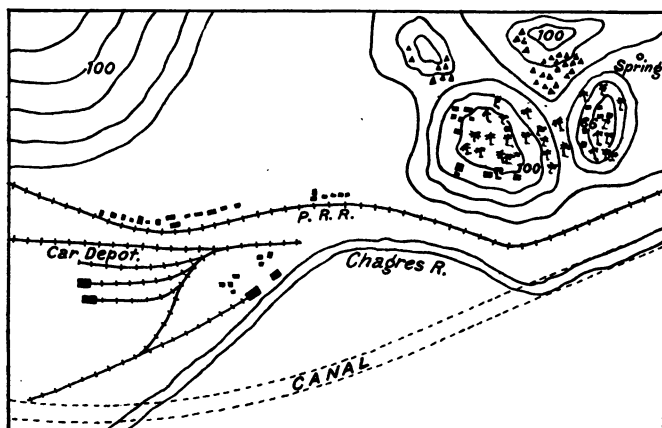


WATER FRONT OF COLON.



40 or 50 frame houses; average capacity, 8 to 12 men; 150 huts. Population: White, 75; natives, 1,200 to 1,500. Repair facilities for small vessels. Water tank for locomotives. Potable well and spring water. Telegraph station. River not fordable. Favorable position for resisting attacks. No bridge over Chagres. Railroad bridge over Gatuncillo, two-thirds mile south of railroad station.

"*Frijoles*.—Nineteen miles from Colon. Best and largest supply of drinking water on the Isthmus. The creek from which this is taken should be guarded; best position for guard on Frijole Hill. Steam pumps; water tanks of 8,000 gallons capacity each. Telegraph office. Only a few frame houses and huts.

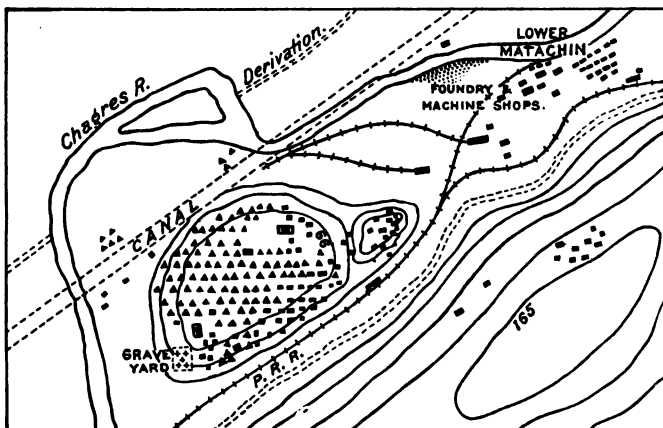


TAVERNILLA.

"*Tavernilla*.—Twenty-one miles from Colon. Canal village; 40 frame houses; 20 huts. Best site for camp on hill to eastward of railroad. Fair supply of spring water.

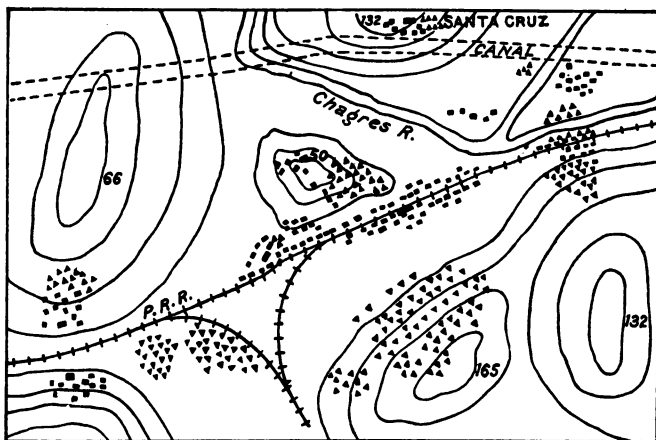
"*San Pablo and Barbacoas Bridge*.—Twenty-three and one-half miles from Colon. Twenty frame houses; 100 huts. Population, 60 whites, 1,800 others. No water in village. Spring on hill at Aspinwall end of bridge, 400 gallons a day. No telegraph. Barbacoas Railroad bridge over Chagres, 700 yards northwest of railroad station, built of iron; stone piers; is 617 feet long; plank footway between the rails. Aspinwall end furnishes best site for camp or guard—one of the most important on line of transit—should be held by strong guard.

"*Gorgona*.—Twenty-eight and three-fourths miles from Colon. Comparatively healthy. Small springs. No telegraph. Forty frame houses; 350 huts. Eighty whites, 2,000 natives, etc.



GORGONA.

"*Matachin*.—Thirty miles from Colon,  $17\frac{1}{2}$  from Panama. Unhealthy in late summer and fall. Eighty frame houses, capacity 600 to 800; 200 huts. One hundred whites, 1,000 to

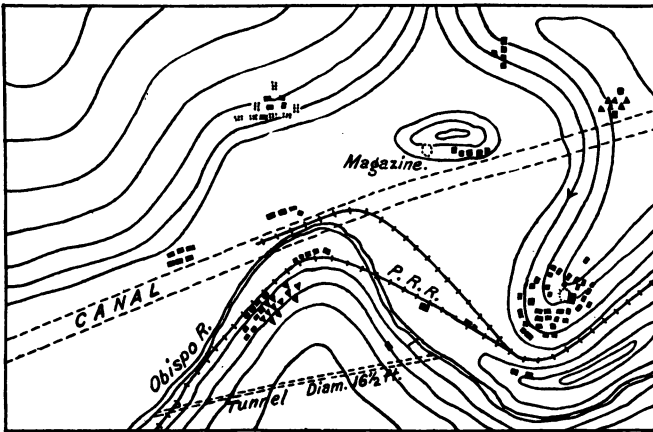


MATACHIN.

3,000 natives, etc. Spring on east slope of hill. River water dangerous. Trail for pack animals between Gorgona, Matachin, and southward. Suspension and pontoon bridges

across Chagres. Chagres here turns to northeast. Strongest site for resistance on hill near railroad track, one-fourth mile to southward of station. It is unhealthy. Best site for camp on hill immediately in rear of railroad station.

"*Gamboa*.—One mile from Matachin. Excellent site for quartering men, holding them ready for active operations at either end of transit. Exceptionally healthy. One hundred huts; 500 native. River supplies good drinking water. Bridle path to Cruces (up Chagres) and Panama. River current very strong.



LOWER OBISPO.

"*Obispo (lower and upper)*.—Thirty-one and one-fourth and 32 miles from Colon. Sanitary conditions unfavorable. Lower Obispo, 90 frame houses, 25 huts; 40 whites, 50 natives. Upper Obispo, 45 houses, 80 huts; 25 whites, 300 natives. Lower Obispo Hill commands river toward Gamboa, path from Gamboa to Lower Obispo, and railroad toward Empire. Railroad bridge over Obispo River at Upper Obispo. Upper Obispo Hill best site from which to guard bridge. Water tank for locomotives. Obispo River supplies fair drinking water.

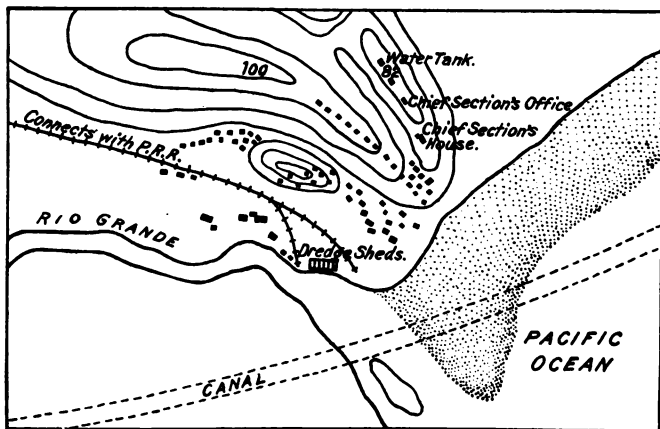
"*Emperador (or Empire)*.—Thirty-six miles from Colon, 11½ from Panama. Eight hundred and fifty frame houses; capacity, 4,000. Eighty whites, 3,300 natives, etc. Fuel abundant. Water brought from Camacho Creek. Best site for camp or resistance on hill. Machine shops. Telegraph.

"*Culebra*.—Thirty-seven and one-eighth miles from Colon,

10½ from Panama. The summit. Strong strategic position. Ample quarters—800 frame houses, 400 huts. Good water supply from springs. Machine shops.

"*Paraiso*.—Forty miles from Colon, 7½ miles from Panama. One hundred and twenty-five frame houses, 100 huts. Fifty whites, 750 natives. Small springs give limited supply of water. Telegraph.

"*La Boca*.—The Pacific entrance to canal, a suburb of Panama. Railway connection (back of town) with Panama Railway."



LA BOCA.

**Panama.**—"About 1518 Governor Pedrarias Dávila transferred to the native village of Panama the episcopal see and the civil government, which had been since 1514 at Santa Maria de la Antigua, in Darien.

"The name of Panama is believed to have come to these coasts from an aboriginal word which signified "abundance of fish," according to several historians, although according to others it was derived from the fact that the town was founded near some large trees which the natives called 'Panama.'

"Hardly had three years passed after the transfer of the ecclesiastical and civil governments to the village of Panama, when the latter obtained a city charter from the Emperor Charles V (1521).

"Panama had a mint, and in 1535 it was made a royal audiencia (judicial district).



PANAMA. CATHEDRAL PARK.





the Atlantic and Pacific, Panama and Portobelo had to suffer repeated attacks, either from English and French pirates or from the Spaniards themselves, who raised the standard of rebellion in Peru and Central America.

"The ancient city of Panama was situated about 4 miles to the east of the city now bearing the same name. Travelers still find the ruins of that wealthy city, although they are mostly hidden by an exuberant vegetation. The remains of many public buildings are still seen, such as the tower of the cathedral, the walls of churches, bridges, turrets, cisterns, and part of the pavement of the streets, all covered with enormous fig trees, pepper shrubs, and numerous yerbas moras (a medicinal herb), whose flowers perfume the air with fragrant odors.

"**Modern Panama.**—After the destruction of the city Governor Fernández de Cordova resolved to change the site and chose for the purpose a short peninsula surrounded by steep rocks, easily defended, at the base of Mount Ancon, about 5 miles southeast of the destroyed city.

"The celebrated engineer Alonso de Villa-Corta constructed a fortified town, the like of which does not exist anywhere else in South America, unless it be Cartagena. He surrounded it with very strong walls several yards thick. The uneven and rocky ground which was inclosed was filled in afterwards, so that the surface of the city became smooth and level, with an elevation of over 20 feet, there having been erected, at each end of the front facing the Pacific, two colossal defensive bastions, in view of which there was a time when it would have been an exceedingly serious and dangerous undertaking to attack this city.

"A century ago Panama was considered one of the richest and most beautiful cities in the world. The galleons which arrived there laden with the rich treasures from Peru, together with the continual passage of adventurers and emigrants bound for Peru, rendered it the most frequented landing point of all western America. \* \* \*

"Owing to its advantages and conveniences Panama would have continued to progress had it not been for a series of causes which started its decline.

"At the time of the great immigration to California and during the period of greatest activity in the work on the isthmian railroad the hope was revived that the city would

return to its former prosperity. It was frequented by innumerable travelers, and its harbors were visited by thousands of vessels, but the opening of the railroad between San Francisco and the Eastern States of the North American Union almost completely exhausted these new sources of wealth.

"Then came the great fire, which occurred March 7, 1878, and which almost entirely completed the work of destruction which had been begun years before.

"Following upon the fire came the epoch of the inauguration of the canal in Panama, an epoch of feverish business activity, when money flowed in torrents.

"The city was soon rebuilt and immediately began to acquire those buildings, parks, and promenades, as well as most of the enterprises, which give it the seal of importance and beauty which it now possesses.

"Unfortunately on June 13, 1894, another conflagration destroyed a large part of the northern part of the city, in which there were some splendid buildings. However, many of them have been rebuilt already and new buildings are continually going up, there being a marked tendency nowadays to build of rubble masonry instead of wood, which is a constant menace in these hot climates.

"NOTABLE BUILDINGS.—The cathedral is situated in the principal square, and was begun to be built in 1620. This building consists of a spacious principal nave and four lateral ones, and it possesses a magnificent organ and notable pictures and images.

"The episcopal palace is situated on the north side of the cathedral park, and is a large, beautiful building of the renaissance style. Its façade is elegant and adorned by some fine moldings.

"The government palace is a solid and convenient edifice on the southern lateral coast of the mercado (market) cove. It faces the north and receives in consequence the breezes which come from that direction.

"The Grand Central Hotel, which is, without doubt, the finest of all the private structures, is situated in the cathedral park. It has four stories and occupies a quarter of a block.

"In the same square the Interoceanic Canal Company has its offices in another notable building of solid and elegant construction, modern style, and four stories.

"The municipal palace (city hall), a handsome edifice with

three tiers of galleries in its front and of considerable height, stands in Cathedral Park also. In its beautiful main hall the cabildo (city council) meets and the sessions of the departmental assembly are held. Other parts of the building are occupied by the Columbus Library and the offices of the city treasury.

CHARITABLE INSTITUTIONS.—“The department of charity is well attended to in the cities of Panama and Colon, which, being the most populous cities in the Isthmus, are the places where charitable institutions are most needed. In the city of Panama are situated the following:

“*Hospital of the canal company*.—This establishment, considered the best of its class in South America, was constructed on the best hygienic principles at the expense of the original canal company for the exclusive use of the employees and laborers in this colossal enterprise.

“It consists of 18 large rooms, and is attended by the Sisters of Charity. Each room contains 40 beds. It has a complete apothecary’s shop and, besides, a surgical room supplied with all the apparatus necessary in surgical operations.

“It occupies a charming position, dominating the city and the beautiful bay from the elevated position on the sides of Mount Ancon where it is built. It is surrounded by gardens, shade trees, and palms. The excessive heat which prevails in the city during the hottest months of summer is never felt here.

“*Foreign hospital*.—This hospital, also situated on Mount Ancon and built on the same hygienic principles as that of the canal company, was built under the auspices of the foreigners residing in the city, who contribute to its support. It has a capacity for 70 to 80 patients. Foreigners and sojourners can secure good treatment in this establishment by paying a certain sum, varying according to category and service required, but not generally exceeding \$1 per day.

“*Santo Tomas Hospital*.—This hospital is in the city and is a purely charitable institution. It is attended by Sisters of Charity and governed by a board of five members.

“The number of Sisters of Charity attending in the hospital is eleven, one acting as superior.

“*The pesthouse of Punta Mala*.—By this name is designated a house on the outskirts of the town where lepers are kept. This house is far from being a regular pesthouse, and this

fact is realized by the Government, which is making efforts to found one. For this purpose the decree of January 13, 1897, was issued, creating the leprosy board, composed of nine members, among them being two physicians.

"The total number of lepers in the department is 50, the number of cases in the province of Panama being 24, in Colon 24, in Chiriqui 1, and in Los Santos 1. There were only 23 cases in 1892, of which 18 were in the province of Panama and 5 in that of Colon. It is believed on good grounds that the great increase was not due to contagion or spontaneous contraction of the disease, but to the immigration of infected persons.

"*The Bolivar Asylum* (southern extremity of the Bocas del Toro highway).—The Bolivar Asylum is a purely charitable institution, founded in this city by the philanthropist, Gen. Tomás Herrera, and other gentlemen and distinguished Panamanian ladies. It is an institution of refuge for beggars principally, but its doors are open to all persons unable to earn a livelihood or temporarily out of employment, who here find shelter and food until they can improve their condition. It does not admit insane people or persons suffering from a contagious disease. It is sustained mainly by voluntary contributions, but also receives a certain quota from the profits of the Panama lottery. The establishment is spacious and well ventilated, and the service and sanitation are good. The average daily number of persons sheltered is calculated at 155.

"*Orphan Asylum of the Daughters of San Vicente de Paul*.—This institution, presided over by the Sisters of Charity, was founded in 1895 by the Rev. Mr. Parra, who is now bishop of Pamplona. He donated to it the building which it occupies. Children taken in here are given food, shelter, and a good Christian education.

"*Asylum of San José de Malambo*.—This is an establishment for orphans, founded by Mr. Manuel Jaén in 1889 and put in operation in 1890. It is a two-story building, is situated in an open, airy place, and can easily accommodate 50 children.

"**PROMENADES, ETC.**—One of the interesting promenades is the ascent to the top of Mount Ancon, which is 236 feet high, and from which a view of the whole city is commanded. When its summit is reached, the eye takes in the whole im-

mense Gulf of Panama and its pretty islands, as well as the Rio Grande throughout its whole extent. \* \* \*

"All the environs of Panama are occupied by extensive and beautiful haciendas (farms), where the owners and farmers pass the hottest part of the summer, for which reason the country is crossed by paths and good roads, through some of which carriages can conveniently pass. \* \* \*

"The nearest and most popular summer resorts are Sabanas, Taboga, Gorgona, Chorrera, El Valle, Anton, and many others. All these places have many clear brooks and enjoy an agreeable temperature. Provisions are also plentiful, and the milk is excellent and cheap. This is a valuable resource, for during the months of December, January, and February the heat renders living in the capital very trying.

"The means of reaching these summer resorts are cheap and easy. Taboga is one of the islands situated in front of the city, and is reached by sailing vessels in from one to four hours, according to the breeze blowing, while in steamboats hardly three-quarters of an hour are consumed in the trip.

"Sabana is reached in a carriage and Gorgona by rail, the latter place being situated at an elevated and agreeable point on the line.

"To La Chorrera, El Valle, Anton, and other towns of the interior the trip is made via the Pacific to the ports of La Chorrera, Capira, Chame, San Carlos, etc., and thence by bridle paths."—*Directory of Panama, 1898.*

"Panama is a city of about 30,000 inhabitants. To the northeast of the city is located a small harbor, where small steam vessels and schooners may enter at high tide. A garrison of about 450 well-drilled Colombian troops is stationed in the cuartel in the "Plaza des Armas" in the city of Panama. These troops, commanded by a Colombian general, drill according to Upton's tactics, and use the same bugle calls as those used by the United States Army."—*Report of Capt. C. B. Humphrey, Twenty-second Infantry, 1903.*

"Panama is  $47\frac{1}{2}$  miles from Colon. Ample quarters; best at railroad station. Hospitals for more than 500. Best position for camp at railway yard and wharf. Ancon Hill dominates and commands all approaches. Usual garrison, 500

troops. Boat landing at railroad wharf or beach. Another landing at half tide at foot C. de Narino. One revenue cutter on Pacific coast. Rise and fall of tide, 15 to 22 feet.

"The time from Panama to New York is seven days; San Francisco about twenty days. There are two cable companies in the city, an electric-light plant, and an electric street-car line, which runs from one end of the city to the other.

"*Dívala*.—Dívala has an elevation of 538 feet and is situated near the west or right bank of the river of the same name.

"*David*.—David, 60 miles from the frontier, is the capital of the province of Chiriqui, contains about 9,000 inhabitants, possesses gold mines and numerous herds, and has excellent pasture lands. The elevation of David is 66 feet above the sea.

"*Santiago*.—At a distance of 190 miles from the frontier we touch the town of Santiago, the capital of the province of Veraguas. Santiago has a population of about 6,000 inhabitants, who are occupied with the extraction of gold, the raising of stock, and the fabrication of cotton and woollen goods. The town has an elevation of 302 feet above the sea.

"*Agua Dulce*.—Agua Dulce is a village in the Province of Coclé, the capital of which is Penonomé, with a population of about 15,000 inhabitants. The province possesses a very fertile soil, on which flourish large plantations of tobacco, cacao, and coffee.

"*Anton*.—Proceeding via Nata and crossing numerous streams almost at right angles, but on very nearly level ground, the town of Anton is attained at a distance of 248 miles from the assumed boundary.

"*San Carlos*.—The next important place touched is San Carlos, situated very near the Pacific Ocean, and belonging to the Province of Panama. Passing by Chamé, Capira, and the town of Chorrera, the city of Panama is finally reached at a distance of 334 miles from the Rio Golfito."—*Report of Intercontinental Railway Commission, 1891-93, Vol. I.*

"*Nata*.—Nata is one of the oldest settlements in America, dating from 1512, some time before the name of Mexico was known in Europe.

"*Bugaba*.—Bugaba, near David, is situated in the vicinity of the location of the old graves, full of gold ornaments, which, in 1860, gave the Chiriqui district a temporary renown as a new El Dorado."—*New York Sun*, November 15, 1903.

"*Bocas del Toro* is a thriving town rapidly coming into prominence as the point of export for a large district, rich in native products, and with an immense area of unoccupied land, suitable for the cultivation of cocoanuts, bananas, and other tropical fruits for which the demand is apparently a matter of constant growth.

"Rice and sugar in the low lands and coffee and cocoa in the higher districts of the interior may also be cultivated to great profit and brought to this port by roads over a country which offers great facilities for cheap construction and easy maintenance.

"Although the population is made up to a considerable extent of natives of the West India Islands, who are British subjects, the export trade is entirely in American hands, and the import trade is chiefly American, with slight diversions in favor of Jamaica and Colon."—*Bulletin No. 33, Bureau of American Republics. British Consular Reports for 1890, Colombia*.

"*SAN BLAS DISTRICT*.—This district, situated to the northeast of Colon, at a distance of about 30 miles, which has not been opened to civilization or settlement—as the Indians inhabiting its coast and mountains are practically unconquered and openly hostile to Colombian rule—is but little known."—*Colombia. British Diplomatic and Consular Reports of Trade and Finance. Report for the year 1899 on the Trade of the District of Panama*.

#### (e) **LINES OF TRAVEL AND COMMUNICATION.**

**CANALS.**—"In 1878 the Colombian Government granted a concession for building the Panama Canal, and in the following year M. de Lesseps took the matter up. A company was organized, with a nominal capital of 600,000,000 francs (\$115,800,000), to be obtained by popular subscriptions in France, and the work of construction was begun in October, 1881. The canal was to follow much the same route as that of the railway from Colon to Panama. It was to be 54 miles in length, the bottom to lie 28 feet below the mean level of the oceans, the width to be 72 feet at bottom and 160 feet at



SCENE ON THE PANAMA CANAL.



top, except in the section through the Culebra Ridge, where the depth was to be 9 meters (29.52 feet), the bottom width 24 meters (78.91 feet), and the top width 28 meters (91.86 feet). The special difficulties to be encountered were the piercing of the Cordillera and the overflow of the Chagres River and its tributaries. In January, 1884, a little more than two years after beginning the work, but one-thirtieth of the excavation had been completed, although during 1883 a force of 11,000 men was employed. The cost of the work proved to be enormous, and much of the money, it was claimed, was wasted by extravagant management.

1881  
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“According to the handbook of Colombia published by the Bureau of American Republics, the canal company had raised, up to June 30, 1886, the sum of 772,545,412 francs (\$149,101,264), or 172,545,412 francs (\$33,301,264) more than the original estimate, and it was then stated that nearly as much more would be required to complete the work. Finally, in March, 1899, work was stopped for want of funds, and provisional administrators were appointed by the French courts. Various schemes of reorganization were proposed, but little of actual importance was effected until 1894.”—*Commercial Directory of the American Republics, 1897*.

“In 1894 a new company was formed, which obtained a concession for ten years, extended in 1900 by six years, so as to terminate in April, 1910. By that time the canal, according to the annual report of 1899, might be completed at a cost of 512,000,000 francs (\$20,480,000). On January 4, 1902, the board of the company offered to sell to the United States all their rights and property. In view of this offer the United States Isthmian Canal Commission recommended the Panama route, and on January 22, 1903, a treaty was signed whereby the United States obtains a lease of the necessary strip of land for one hundred years, renewable at the pleasure of the United States. The treaty between Great Britain and the United States, signed November 18 and ratified by the United States Senate December 16, 1901, provided for the neutralization of the interoceanic canal by whatever route it may be constructed and for its use on equal terms by vessels of all nations.”—*The Statesman's Year Book, 1903*.

“The natural attractions of the Panama route lie in the combination of a very narrow isthmus with a low summit. The width of the Isthmus is less than 35 miles in a straight

line, while the summit is barely 300 feet above mean tide which, though higher than the Nicaragua summit, is less than half the height of any other which has been investigated. The high portion of the Isthmus is limited to a width of about 6 miles near the Pacific side, and the Chagres River affords access by canoe navigation to within 15 miles of the Pacific Ocean.

"The Isthmus here runs nearly east and west, but the course of the railroad or canal is from northwest to southeast, the Pacific terminus being about 20 miles farther east than the Atlantic. The Atlantic port is Colon, and the Pacific port Panama. Neither is a first-class harbor. The defect of Colon Harbor is its exposure to strong northerly winds, which, though rare, occur for periods of a few days every year, and while they prevail ships may go to sea for safety. Panama Harbor is a roadstead, behind islands, at the head of a great bay.

"The old Panama Canal Company, organized in 1879, projected a tide-level canal, 47 miles in length, between the two oceans. Five miles were in the coastal plain near Colon, 24 in the valley of the Chagres, 6 in the hills which form the divide, 7 in the valley of the Rio Grande, a small stream running from the hills into Panama Bay, and 5 in the harbor approaches. Two principal difficulties were encountered: The line of the valley of the Chagres involved an excavation below the bed of the river, which rises in the mountains east of Panama in a district subject to violent rains and at times floods its entire valley; the passage of the divide in the Culebra region involved an excavation of unprecedented dimensions.

"Before the stoppage of work by the old French company the scheme of a tide-level canal was abandoned, and various plans for a canal with locks were proposed, the summit level being placed at different heights, the highest being 160 feet above mean tide, to which high level it was proposed to pump the water. The new French company adopted a scheme in which the summit level of the canal is placed at a minimum elevation of  $97\frac{1}{2}$  feet, approached by 4 locks in each direction, to be supplied with water from the upper Chagres, impounded by a dam at Alhajuela and brought through a conduit 10.4 miles to the canal at Obispo. By this arrangement the excavation in the continental divide was reduced within such limits that it was thought the work could be finished in eight years.

"By the construction of a dam across the Chagres at Bohio the river between that point and Obispo was converted into a lake of sufficient dimensions not to be seriously affected by flood discharges, while diversion channels were to be constructed on both sides of the canal from this dam to the sea. With a carefully designed system of sluices and controlling works the violence of the floods was to be checked by impounding the water both above the Alhajuela dam and in Lake Bohio, so as to keep the flow below the Bohio dam within the capacity of the two diversion channels. The adoption of this scheme by the French engineers in preference to a simpler plan, which was fully discussed by them, was determined by the limits of time to which the company was restricted. As the conditions would be different if the canal were constructed by the United States, the commission has adopted a simpler plan, avoiding complicated constructions like the conduit for the summit supply of water and making the regulation of the floods as nearly as possible automatic.

"With the change from the tide-level canal to a canal with locks, a third problem was added to the other two—the supply of water for the summit level. The only available source of supply is the Chagres River. This brings the water supply into such intimate relation with the control of the flood discharge that the two become practically one and must be treated together. The discharge of the Chagres at Bohio varies from a minimum of about 350 to a maximum of over 100,000 cubic feet per second, the extreme flood discharge being about 300 times the low-water discharge. The estimated requirement for the operation of the canal, with an annual traffic of 10,000,000 tons net register, is 1,067 cubic feet per second. The discharge of the Chagres exceeds this in some years for every month, and in all years, except for a short period in February, March, and April, provision must be made for the storage of enough water to supply the deficiency during these three dry months. The best storage place for this water is in the lake formed in the valley of the Chagres, making it of sufficient depth to allow the needed supply to be drawn off without lowering the level enough to impede navigation.

"The greatest flood of which there is any record occurred in 1879. From the imperfect information we have it has been

estimated that it may have reached a maximum discharge of 75,000 cubic feet per second at Gamboa, and 110,000 at Bohio. There is no record of any other flood in which the discharge at Bohio exceeded 80,000 cubic feet per second, while the floods in which it exceeds 50,000 are at such rare intervals that their effect on navigation would not be serious. The works should be so designed that a flood of 70,000 cubic feet per second would produce no currents which would interfere with navigation, the limit of such currents being fixed at 3 feet per second, and that a flood of twice this amount, or a discharge of 140,000 cubic feet per second, while it might temporarily suspend navigation, should not injure the structure of the canal.

"No location suitable for a dam exists on the Chagres River below Bohio, and while this location is not without difficulties it has the great advantage that about 3 miles southwest of the dam, near the head of the Rio Gigante, a tributary of the Chagres, there exists an excellent site for a spillway, by which the discharge from the lake could be kept well away from the dam and accessory works. The height of this spillway would regulate the height and area of the lake. After careful consideration the Commission has decided to fix this height at 85 feet above mean tide and to make the spillway in the form of a fixed weir 2,000 feet long. At elevation 85 the lake has an area of  $38\frac{1}{2}$  square miles, more than 1,000,000,000 square feet. The height of  $5\frac{1}{2}$  feet from the crest of the weir to the elevation required to pass the maximum discharge would represent the impounding of more than 6,000,000,000 cubic feet of water. While in the absence of complete data exact calculations can not be made, computations giving reasonably approximate results indicate that no flood has yet occurred which would raise the level of the lake more than a few inches above elevation 90.5 or create a discharge over the weir exceeding 89,000 cubic feet per second.

"The extreme possible effect, however, of a long-continued flood, with a discharge of 140,000 cubic feet per second, for which there is absolutely no precedent, as all great floods are of short duration, will be to raise the water over the spillway to elevation 92.5 and to produce a current of from 5 to 6 feet per second in the narrow parts of the lake. Calculations have been made of the amount of water required to supply the deficiencies in the three dry months. An assumption of a minimum average discharge of 630 cubic feet per second

for ninety days, which is the record of the driest year, gives an aggregate deficiency of 3,398,100,000 cubic feet below the required supply of 1,067 cubic feet per second, which corresponds to a depth of about 3 feet over the whole area of the lake. Under these extreme conditions the level of the lake might therefore be lowered to elevation 82. This represents a range of 8 feet from elevation 82 to elevation 90 in Lake Bohio during navigation. Any rise above 90 would mean nothing more than a swift current for a limited distance, and any fall below 82 would mean a temporary decrease in the depth of water in the canal.

"The overflow of Lake Bohio would discharge through the Giganta spillway into the Pena Blanca Swamp and thence into the Chagres near the point where the Chagres has abandoned its old channel and now flows through the canal excavation made by the old company. It is necessary to construct a new channel of large dimensions west of the canal to take the Chagres. An alternate plan would be to leave the present canal to carry off this water and construct the canal on a new location farther east. A feasible location has been found which, besides keeping the canal safely away from the Chagres, is  $1\frac{1}{4}$  miles shorter than the original French line. The old location has, however, been retained in these estimates, the canal being enlarged to meet the new dimensions adopted by the Commission. This involves a new channel from the Marais de Peña Blanca to the Marais de Agua Clara and a continuous levee for 5 miles along the line of the canal.

"The canal, as thus projected, may be described as follows:

"The excavation begins at the 6-fathom line in the harbor of Colon, with a bottom width of 500 feet, and slopes of 1 on 3 through the bay and lowland 2.62 miles, of which about 1 mile is inside the shore line, forming a narrow, protected harbor. The estimated cost of this entrance and harbor is \$7,334,673.

"From the inner end of the harbor the bottom width of the canal is 150 feet, the side slopes of 1 on 3 being retained for 1.96 miles through the swamp, after which they are reduced to the standard used in firm earth. This level extends 12.56 miles to the Bohio locks. Its estimated cost is \$10,718,288. At Bohio is located a double flight of locks, having a total lift varying from 82 feet at the minimum level of the lake to 90 feet at the maximum, 45 to each lock, the normal lift being 85 feet. These locks are on the location adopted by the

French company. The estimated cost of this flight of double locks, four lock chambers in all, is \$10,982,345.

"Above the locks the canal enters the artificial lake formed by the Bohio dam and known as Lake Bohio. For the first 7 miles it is a broad, deep body of water, affording room for anchorage as well as navigation. Beyond this some light excavations are necessary. At the upper end the channel would be enlarged to provide for the flood discharge of the Chagres, being given a minimum section of 50,000 square feet. The length of the channel in Lake Bohio is 12.59 miles from the locks to the point where it enters the cut through the divide. The estimated cost of this section is \$2,786,449.

"Near to the entrance to the summit cut would be placed a pair of gates 100 feet wide, so that if it should become necessary to draw off the water from the summit cut the level of Lake Bohio would not be affected. These gates would be at the site of a lock proposed by the French company, near Obispo, with a foundation on hard rock. The estimated cost of these gates is \$295,436.

"The summit cut is 7.95 miles long from the Obispo gates to the Pedro Miguel locks. The highest point is about 5 miles from the Obispo gates, where the bottom of the canal is 274 feet below the natural surface of the ground at the sides of the cutting. This is the famous Culebra cut, though the name has often been applied only to the mile of heaviest work. There is a little very hard rock at the eastern end of this section, and the western 2 miles are in ordinary materials. The remainder consists of a hard indurated clay, with some softer material at the top and some strata and dikes of hard rock. In fixing the price it must be rated as soft rock, but it must be given slopes equivalent to those in earth. This cut has been estimated on the basis of a bottom width of 150 feet with side slopes of one on one. While the cut may not be finished with this uniform slope, this furnishes as correct a basis of estimate as can now be arrived at. The entire cut would be lined with masonry walls, finishing at elevation 92, 2 feet above high water, these walls having nearly vertical faces and furnishing benches 38 feet wide on either side of the canal, on one of which the Panama Railroad would be laid, while it is probable that a service track would be placed on the other.

"Much has been said about the instability of the Culebra



PANAMA CANAL. CUT AT BAJO OBISPO.



cut. In point of fact, there is a clay in the upper portion of the deep cut which flows readily when saturated, but which will give little trouble if thoroughly drained; probably nine-tenths of the material would naturally be classed as hard clay of stable character. It would weather somewhat, and the surface might require some repairing with concrete in bad places, a practice common in deep cuttings in Europe. This clay disintegrates rapidly in water, and for this reason the canal prism should be confined between masonry walls. With the provision made for broad benches on each side, on which any slight slides would be arrested, it is confidently believed that no trouble would be experienced. The estimated cost of the 6.02 miles of heavy work is \$41,940,480, and of the entire 7.95 miles between the Obispo gates and the Pedro Miguel locks, \$44,378,335. It would probably take eight years to excavate this section of the canal.

"The Pedro Miguel locks will be similar to the Bohio locks, the aggregate lift varying from 54 to 62 feet. There is an excellent rock foundation here. The estimated cost of these locks, including an adjacent dam, is \$8,496,326.

"A level 1.33 miles long extends from the Pedro Miguel locks to the last lock, which is at Miraflores. The normal elevation of the surface of the water is 28. The estimated cost of this section is \$1,169,611.

"At the end of this level would be located the Miraflores Lock, with a lift varying from 18 feet at high tide to 38 feet at mean low tide. There is a good rock foundation for this lock. A spillway would be required to regulate the height of this level. The estimated cost of this lock and spillway is \$5,720,363.

"For 4.12 miles beyond the Miraflores Lock the canal extends through a low swamp country through which the Rio Grande runs. Occasional rock is found here, but the material is generally very soft, and the canal has been estimated for a bottom width of 150 feet, with slopes of 1 on 3. This brings the canal to a point known as La Boca, where the Panama Railroad Company has constructed a large and substantial wharf. A dredged channel 200 feet wide, with slopes of 1 on 3, would extend here 3.6 miles to the 8-fathom line in Panama Bay. The first 2 miles of this dredged channel are through flats which are bare at low water, where there is a considerable amount of submerged rock. The total cost of this section from the lock to deep water is estimated at \$12,366,914.

"Besides the works embraced in the excavation of the canal itself, there will be five outlying works which must be considered. These are the Bohio dam, the Gigante spillway, the diversion of the lower Chagres opposite Gatun, the diversion of the Gatuncillo east of Gatun, and the diversion of the Panama Railroad around Lake Bohio.

"The Bohio dam is the most important structure on the line. A dam of either earth or masonry is feasible, the latter being the more expensive. The French plan contemplates a dam of earth. It has been decided, however, to use the masonry type for the purpose of these estimates. The foundation must be carried to rock, the depth to which has not yet been estimated at all points, though the maximum is known to be not less than 128 feet below mean tide. The estimated cost of such a dam is \$8,500,000.

"The Gigante spillway, which is a structure of considerable magnitude, is very simple. There is a good rock foundation at or above tide level for the entire length of this spillway. It would consist of a masonry dam with a crest at elevation 85, terminating in an apron at elevation 65, with a solid foundation below this level, the apron being anywhere below the present surface of the ground. The foundation below elevation 65 would be put in first, and before the flow of water through the present river at the site of the Bohio dam is checked. The water after passing over this spillway would flow across the country about a mile to the swamp known as the Marais de Peña Blanca. The elevation of the surface of this swamp is now 22.3 feet, so that the water would have a fall of 42.7 feet in this mile, which fall would be materially reduced in extreme floods by the backing up of water in the swamp. Plans have been prepared for this spillway, and the estimated cost is \$1,124,524.

"A channel must be cut from the Marais de Peña Blanca to the Marais de Agua Clara, the cost of which is estimated at \$1,448,076.

"A channel was cut by the old canal company to divert the Chagres from the canal opposite Gatun. This channel, however, is of very inadequate dimensions, and a new channel, part of which will be an enlargement of the present one, should be cut here. It should have a cross section of 10,000 square feet. Rock would be encountered in its excavation, and its cost has been estimated at \$1,929,976.





MOLE EXTENDING FROM THE MAINLAND TO THE LARGE WHARF AT THE MOUTH OF THE PANAMA CANAL, ON THE PACIFIC.

"A diversion channel, intended to take part of the waters of the Chagres, was constructed by the old company along the east side of the canal at Boca Grande, back of Colon. This cut across the Gatuncillo near Gatun and the portion of it north of this point is available as a new channel for the Gatuncillo. Some work must be done on it, especially at the crossing of the Panama Railroad, where the piers for a new bridge are completed. The cost of putting this channel into service is estimated at \$100,000.

"From Bohio to the Obispo gates the Panama Railroad must be rebuilt for  $15\frac{1}{2}$  miles on an entirely new location, with a bridge across the Chagres below Gamboa. An estimate made from approximate profiles indicates that the cost of this diversion will not exceed \$75,000 a mile, or \$1,162,500. From the Obispo gates the railroad would be carried for 6 miles on the bench formed by the retaining wall on the east side of the Culebra cut, these 6 miles being estimated to cost \$10,000 a mile, which includes only track laying, ties, and ballasting. Beyond this will be a mile of light work, estimated at \$25,000, while the main track will have to be raised for 2 miles farther, at a cost of \$20,000. Combining these figures, the total cost of the diversion of the Panama Railroad becomes \$1,267,500.

"Summing up the several figures already given, the total estimated cost of completing the Panama Canal is as follows:

Colon entrance and harbor .....	\$7, 334, 673
Harbor to Bohio locks, including levee .....	10, 718, 288
Bohio locks, including excavation .....	10, 982, 345
Lake Bohio .....	2, 786, 449
Obispo gates .....	295, 436
Culebra section .....	44, 378, 335
Pedro Miguel locks, including excavation and dam .....	8, 496, 326
Pedro Miguel level .....	1, 169, 611
Miraflores locks, including excavation and spillway .....	5, 720, 363
Pacific level .....	12, 366, 914
Bohio dam .....	8, 500, 000
Gigante spillway .....	1, 124, 524
Channel between the marshes .....	1, 448, 076
Chagres diversion .....	1, 929, 976
Gatuncillo diversion .....	100, 000
Panama Railroad diversion .....	1, 267, 500
<b>Total .....</b>	<b>118, 618, 816</b>
Engineering, police, sanitation, and general contingencies ..	23, 723, 763
<b>Aggregate .....</b>	<b>142, 342, 579</b>

"This estimate is for the completed project. A canal begun upon this plan may be opened to navigation before its final completion. If single instead of double locks be used, and the bottom width be made 100 instead of 150 feet, the cost will be reduced \$26,401,364, and the estimate becomes \$115,941,215.—*Interoceanic Canal, Senate Report 1337, part 4, 1901.*

"A canal is being built from the Chanquinola River, about 18 miles from Bocas del Toro, to Almirante Bay, opposite Bocas de Drago, the concessionnaire of which is Mr. N. T. Snyder, the owner of nearly 4,000 acres of banana land in Chanquinola. This canal is about 8 miles in length, and will open to commerce a wide area of the richest banana country in the world, of which about 6,000 acres are already cultivated and bearing fruit.—*Commercial Relations, 1902.*

"WATER TRANSPORTATION.—The port of Panama, situated on the west side of the bay of that name and located at one of the most interesting geographical positions in the Americas, if not of the world, is of the greatest importance. It is a halfway station on the highway of commerce between Europe and Asia, yet it has no direct line to the Asiatic ports. By the way of Colon and the Panama Railroad it is connected with Europe and with the eastern part of the United States by many steamship lines, to wit: The Royal Mail Steamship Company (mail line, British); The Royal Mail Steamship Company (cargo line, British); Compagnie Générale Transatlantique, of Saint-Nazaire (French); Compagnie Générale Transatlantique, of Havre and Bordeaux (French); Compagnie Générale Transatlantique, of Marseilles (French); West Indies and Pacific Steamship Company, of Liverpool (British); The Harrison Line, of Liverpool (British); Hamburg-American Packet Company, of Havre and Hamburg (German); The Colombian Line, of New York (old Pacific Mail Steamship Company, United States); Compañía Transatlántica, of Barcelona (Spanish); The Italian Line, of Genoa (Italian). The fleets of these companies aggregate some 65 vessels, some of which are among the finest sailing across the ocean.

"*South American Steamship Company.*—This company has steamers leaving this port every other week bound for Chile, the termini being Panama and Valparaiso, a distance of something over 3,000 miles. The itinerary of the line is as fol-

lows: Buenaventura, Tumaco, Esmeraldas, Nahia, Manta, Cayo, Bellenita, Guayaquil, Tumbes, Payta, Techura, Pimentel, Eten, Pacasmayo, Selaverri, Chimbote, Samanco, Casma, Huarmey, Supe, Huacho, Callao, Corro Azul, Tambo de Moro, Pisco, Lomas, Chala, Quilca, Mollendo, Ilo, Arica, Iquique, Tocopacilla, Tobija, Antofagasta, Taltal, Chanaral, Caldera, Carrizal Bajo, Huasco, Coquimbo, Valparaiso. The steamers of this line call at all of these places. The regular ports of call for the largest steamers are Guayaquil, Techura, Pimentel, Callao, Mollendo, Iquique, and Coquimbo. The distance from Panama to Guayaquil is 800 miles; from Guayaquil to Callao, 600 miles; from Callao to Iquique, 650 miles, and from Iquique to Valparaiso, 800 miles. This company secures its coal from Corral, some 400 miles south of Valparaiso, where splendid coal deposits are found.

“The fleet of this line is composed of the following vessels:

Steamers.	Capacity.	Horse-power.	Steamers.	Capacity.	Horse-power.
	<i>Tons.</i>			<i>Tons.</i>	
Aconcagua.....	3,000	3,100	Limari.....	900	650
Imperial.....	3,000	3,000	Chillan.....	600	450
Mapocho.....	3,000	3,000	Biobio.....	600	400
Maipo.....	2,950	2,000	Spartan.....	600	400
Cachapoal.....	2,755	1,900	Aquila.....	600	400
Lantara.....	2,600	1,600	Litcal.....	600	400
Amazones.....	2,500	1,800	Longavi.....	400	370
Itata.....	2,600	1,500	Maule.....	250	240
Copiapo.....	1,800	1,900	Pudeto.....	300	230

“Only the largest of these vessels come to this port, viz, the *Aconcagua*, *Imperial*, *Mapocho*, *Maipo*, and *Cachapoal*. The other steamers, especially the small ones, do coastwise service and ascend the rivers as far as possible, so that from Valparaiso to Panama there is not a port of importance in Chile, Peru, and Ecuador that can not be reached by one of these vessels.

“The passenger (first-class) rates are, from Panama to Guayaquil, £13 15s. (\$66.81); from Guayaquil to Callao, £20 (\$97.32); from Callao to Valparaiso, £11 17s. 6d. (\$57.79); from Panama to Valparaiso, £31 17s. 6d. (\$154.63).

“The rates to all intermediate points are somewhat proportional to distance. The passenger traffic is considerable both ways. The line is controlled by Chilean capitalists.

“*The Pacific Steam Navigation Company*.—This is an English corporation (limited), with headquarters in Liverpool. It runs steamers all over the world, but has a distinct line

doing service with Valparaiso, from which port it runs a special line of steamers to Panama. The fleet is composed as follows:

Steamers.	Capacity.	Horse-power.	Steamers.	Capacity.	Horse-power.
	<i>Tons.</i>			<i>Tons.</i>	
Arequipa .....	3,190	2,600	Pizarro .....	2,160	1,900
Bolivia .....	1,925	1,800	Quito .....	1,266	1,100
Coquimbo .....	1,821	1,600	Santiago .....	3,190	2,800
Casma .....	592	450	Serena .....	2,394	2,100
Manavi .....	1,041	900	Morro .....	170	150
Puno .....	2,388	2,200			

"These steamers make trips fortnightly regularly and work somewhat in conjunction with the South American Steamship Company, although they are distinct lines under different managements. There was a time, not so very long ago, when they ran a powerful competition, but they have pooled their issues.

"The termini of this particular line are Valparaiso and Panama, but it runs a steamer regularly to Puntas Arenas and back, principally for the cattle business. The itinerary of this company is identical with that of the South American Steamship Company. The rates for passengers (first class) from Valparaiso to this place and intermediate points, and vice versa, are identical with those of the same company, as are the rates of freight.

"This company owns in the Bay of Panama an island called the "Little Toboga," leased from the owner for a number of years. On this island they have waterworks, which furnish them all needed water (spring) for their steamers. They maintain in this bay a small steamer called the *Morro*, of 170 tons, to supply their vessels with water. This lease is exceedingly valuable, as the water is excellent and, so far as known, the only spring water in this part of the world.

"*North American Navigation Company.*—This company has a fleet composed of the following vessels:

Steamers.	Capacity.	Horse-power.
	<i>Tons.</i>	
St. Paul .....	606.61	400
Mexico .....	1,240.72	700
Keweenaw .....	2,511.40	2,000
Saturn .....	2,268.15	1,900
Progreso .....	1,919.13	1,700

"This company was organized early in 1893 in San Francisco by some of the leading merchants of that place, in opposition to the Pacific Mail Steamship Company. It operates in conjunction with the Panama Railroad, through bills of lading being given from San Francisco direct to New York via Panama and Colon, and vice versa. All the vessels are chartered from eastern parties for the term of one year, and the line is controlled by Capt. W. L. Merry, president of the company, with general offices in San Francisco.

"It has no accommodations for passengers (first class) and does not pretend to carry any, unless upon exceptional occasions, and then only as deck passengers. It carries a large amount of freight both from San Francisco to Panama, and vice versa. It broke the monopoly which the Pacific Mail Steamship Company had enjoyed on this coast for many years. The trips are somewhat irregular, there being no fixed dates for arrivals or departures, but so far they have averaged two trips per month each way. The rates of freight, owing to the competition with the Pacific Mail Steamship Company, are very low and irregular. They charge what they can get—sometimes less than a cent per pound, often only \$2 per ton.

"The ships of the North American Navigation Company make the trips direct from here to San Francisco and return, calling on rare occasions at Mexican and Central American ports. The distance from San Francisco to Panama is 3,940 miles.

"*The Pacific Mail Steamship Company.*—This company has been supplying service between San Francisco, the Isthmus, and New York for nearly half a century. It is not as powerful in these regions as it once was, but promises ere long, if all signs do not fail, more than to regain its former usefulness and greatness. It is doubtful if it will ever have a foothold south of Panama, nor does it seem to care for any. In fact, it has not protected its own coastwise trade north of Panama, as it has allowed the Pacific Steam Navigation Company (British) to encroach on its domain, that line now having a steamer doing service at the expense of the Pacific Mail as far north as Puntas Arenas, in Costa Rica. This service promises not to stop there, and it would not be surprising to see the Pacific Steam Navigation Company steam all the way to San Fran-

cisco, unless the Pacific Mail gives much better service than it now gives.

“The fleet of the Pacific Mail Steamship Company on this route consists of the following vessels:

Steamers.	Capacity.	Horse-power.	Steamers.	Capacity.	Horse-power.
	<i>Tons.</i>			<i>Tons.</i>	
Colon .....	1,843.50	1,700	City of Sydney .....	1,965.88	1,800
San José .....	1,538.25	1,450.50	Costa Rica .....	1,168.80	900
Acapulco .....	1,759.24	1,600	Starbuck .....	1,548.41	1,000
San Blas .....	1,496.50	1,300	City of Panama .....	1,046.30	800
San Juan .....	1,496.50	1,350	Barracouta (Brit.) ..	1,659	1,400
Colima .....	2,143.23	2,000			

“The last four are doing coasting service as far up as Acapulco. They do not go to San Francisco. The itinerary of the company is as follows: Puntas Arenas, San Juan del Sur, Corinto, Amapala, La Union, La Libertad, Acajutla, San José de Guatemala, Champerico, Ocos, San Benito, Tonalá, Salina Cruz, Puerto Angel, Acapulco, Manzanillo, San Blas, Mazatlan, and San Francisco.

“The main points and their distances from Panama are: Corinto, 740 miles; San José de Guatemala, 990; Acapulco, 1,590; Manzanillo, 2,140; San Blas, 2,225. The distance between Panama and San Francisco is 3,920 miles.

“When the coffee ceases to move, one of the coasters is withdrawn from the route, and it then serves as a coal ship in the Bay of Panama.

“The *Barracouta* sails under the English flag.

“Three steamers leave San Francisco for Panama—on the 8th, 18th, and 28th of each month. They return from Panama to San Francisco on the 9th, 19th, and 29th of each month. The coasters leave Panama on the 10th and 29th of each month, and they aim to make about one trip per month for each vessel, but this is not very regular, owing to the difficulties in loading and unloading at the different places in Central America and Mexico, the system of lighterage being in vogue at almost all these ports, there being no piers.—*Commercial Directory of the American Republics, 1897–98.*

“In 1901–2 on the Pacific coast the steamship lines engaged in the isthmian transit trade were (1) the Pacific Mail Steamship Company (American) from San Francisco, Mexican, and Central American ports; (2) the Pacific Steam Navigation Company (British); (3) the *Campaña Sud Americana de*

Vapores (Chilean) from Valparaiso and other Chilean ports, Peru, Ecuador, and Colombia.

"On the Atlantic coast trading to Colon are (1) the Royal Mail Steam Packet Company from Southampton and the Leyland and Harrison Line from Liverpool, both representing British trade; (3) the Campagnie Générale Transatlantique from Havre, Bordeaux, and St. Nazaire, representing the French trade; (4) the Hamburg-American Line from Hamburg, representing the German trade; (5) the Campaña Transatlantica de Barcelona from Barcelona, representing the Spanish trade; (6) the Panama Railroad Company's Steamship Line from New York, representing the United States trade.—*Monthly Bulletin of the Bureau of American Republics, August, 1903.*

"ROADS.—The country between Panama and "Panama Viejo" is very rolling and grown with grass, affording fine pasturage for cattle. Along this road the country would also afford excellent camping facilities for large bodies of troops. The water supply of Panama at the present time is very poor, the only good water being stored in cisterns in the city. Water is also drawn from wells along the railroad near the city, but this is exceedingly impure.—*Report of Capt. C. B. Humphrey, Twenty-second Infantry, 1903.*

"The Sabana road, leading out of Panama, near railroad station, forks a short distance outside of town. The east branch leads to Puerto Bello, the other to Cruces and Gorgona. From the latter, just east of Cardenas River,  $4\frac{1}{2}$  miles from Panama, a path leads off westward to Chorrero, crossing the old line of railway between Pedro Miguel and Rio Grande stations, then up the left bank of the Rio Grande above canal and railroad. One and one-half miles northeast of the Rio Grande station the Cruces-Gorgona road forks, one branch leading to each village. That to Cruces does not again approach the railroad, but terminates in the valley of upper Chagres at Cruces. The Gorgona road beyond the fork crosses the railroad two-thirds mile northwest of Empire and continues to Gorgona, about one-half mile distant from the west side of railroad. A trail continues to Matachin. A trail leaves the Cruces-Panama road a short distance south of Cruces and crosses the railroad one-fourth mile south of Obispo station. It crosses the Gorgona road about 1 mile northward of where the latter crosses the railroad.

"SAN MIGUEL REGION.—The line of our survey from Panama was along the mule trail to Chepo; for the first few miles over a moderately rolling and mostly open country, thence to Juan Diaz River, skirting or crossing the foothills from the central range, from the sloping plain rather, the occasional flat ground heavily timbered and mucky in parts from the late rains.

"From the Juan Diaz to the Pacora pretty much the same. The axial cordillera does not run out spurs to the Pacific. Those spurs range only a short distance from the main mass—wooded, their declivities at an arable pitch—and sink into a very moderately sloping plain apparently 12 to 15 miles wide. The line of the trail is three-fourths in open prairie. Many large hard-wood trees in the forest. The subsoil a red or reddish yellow, loamy clay, underlain by massive clay rock—that is to say, rock in thick beds—solidified shale, as packets of mouth glue becomes solidified. It is a better country than that passed by us between David and Panama—than the last 200 miles of it, at least; better soiled and timbered. The wide plain above noted, bountifully watered by perennial streams, is really, because of erosion, a series of hardly ridges except here and there, but heaves or spits, turtle-backed, generally open grass land, inclined just right for drainage and merging in a flat, adjacent to the sea, 3 or 4 miles wide, composed of the fine wash from the upland and heavily wooded. We found it hard baked and sun-cracked wherever bare of grass. There was a continuous crack 2 to 4 inches in width along the middle of every trodden path, however it might wind or jog. The petrified hoof holes showed it to be soft in the rainy season.

"From Pacora the trail ran northeastward in order to get uphill and follow a ridge crest. Thence across a rolling tract watered by affluents of Rio Chico it won the village of Chepo.

"Chepo village is on high ground, healthful, and free from insects.

"We studied the coast attentively down to San Miguel Bay, there, as farther east, observing that it was characterized by sea plain and knolls or short ridges, both isolated and in clusters, quite detached from the cordillera except at the Chiman. From our night's anchorage at the mouth of Rio Trinidad we discovered a saddle in the spur above Chi-

man village permitting transit from that river southeastward. At San Miguel Bay the surprise awaited us of finding a clear vista northwestward up Congo River toward Chimán, and that the hills between Buenaventura and Punta Brava were outstanding, an unexpected event.

"On the northern side of San Miguel Bay no obstacle appeared. A depression in the low ridge dividing Darien Harbor from the estuary of the Savana River admitted the proposed railroad line to a crossing of that stream, which we selected 5 miles below its confluence with the Lara, after an exploration by canoe.

"The section at high tide was as follows: Beginning on fast ground west side, thence 600 feet of mangrove thicket, depth of water gradually increasing to 10 feet; thence 1,000 feet, deepening to 40 feet; thence 300 feet, shoaling to 35 feet; thence 100 feet, shoaling to mangrove swamp awash; thence 500 feet flat to fast ground on east side. Mean range of tides, about 15 feet. Bottom bluish mud, into which, at the river margin, we were unable to churn down a sharp and heavy pole more than 15 feet. Commander Eastman remarks, concerning this estuary, that the bottom is generally mud, a few exceptions of rock and gravel, but that 10 feet under the mud rock would probably be found.

"From Rio Chico southward the greater portion of the proposed railway line would pass through forest, probably full half of it would be in forest between Panama and Yavisa."—*Report of the Intercontinental Railway Commission, Vol. II.*

"DAVID TO PANAMA.—We resumed field work at David Saturday, January 21, 1893, and, by way of the public trail, generally used as a thoroughfare through San Lorenzo, San Félix, Tolé, La Mesa, Santiago, Aguadulce, San Carlos, Chame, Capira, and Chorrera, arrived at the railroad station in Panama Thursday, February 16, a distance of 292 miles from the start.

"The trail on the whole is fairly direct, but in detail devious and sometimes tortuous, seeking to traverse detached ranges of settlement on the sabanas and ridge-crest passages between them through the forest.

"The Isthmus on the Pacific side, from David to Panama, may be topographically summarized as mountains, sloping plain, and sea flat. The mountain rose first. The plain was

derived mainly from it and spread out under water. The sea flat was similarly derived from the plain after its emergence and built up in the coast shallows above tide level.

"This uniform make is interrupted by spurs from the cordillera at Tolé and La Mesa and by the approach of the cordillera itself to the Pacific near Capira. The plain, too, has been defeated by erosion and is masked to some extent by lofty hummocks and hogbacks, fragments of the ancient mountain mass.

"The geology is variegated clay, red or ruddy yellow at the surface, gray below, underlaid by shale in massive beds, weathering black where exposed.

"The country is watered by numerous streams, almost without exception clear, lively, stony bedded, and firm banked. Timber for railroad use is abundant. The same may be said of stone for masonry if concrete be included in that item. Material for dry walls is scarce.

"Perhaps those who shall utilize our work hereafter would be best served by more particular sketch of our observations.

"From David to Rio Chorchá the line is nearly all in prairie, well populated by native Indians. It passes through forest only at the stream crossings, but the prairies themselves—various in width and a little undulated lengthwise—are lakes of grass, bordered by irregular shores of forest, so that the view was bounded by woods on every hand as we went along.

"Between Chorchá and Boca del Monte the trail held the crest of a sharply serrate ridge in close wilderness, with undergrowth of palms and platanitos, issuing at the latter point on ridge prairies, which extended thence in widening and declining expanses to level plain at San Lorenzo.

"Between the rivers Fomesca and Tupi the topography is irregular and hummocky. There is prairie for about 2 miles approaching Rio San Juan and for about 5 or 6 miles approaching Rio Viejo.

"From the vicinity of Remedios to that of Tolé another jagged profile through forest exists on the line of the trail, ending in sharp ascent.

"Between Callejon Summit and Rio Cobre the country is comparatively rough and uninhabited.

"La Mesa, as the name implies, is seated on a high plain, which declines very slowly eastward and drops off at the end so fast as to necessitate a little development [for railroad

location] near the Vacoi. Thence toward Santiago, crossing affluents of the San Pedro in a wide, scrubby flat, another marked characteristic of the Pacific plain is found. Near all those tributary channels the surface was pitted by rainfall over considerable spaces, 10 to 15 feet deep. The harder layers being cemented by some solution of iron, those pitted areas had the exact likeness of hematite ore diggings.

"From Santiago a wide swell of grassy plain, drained right and left, carried us by imperceptible descent to the Rio Santa Maria. Thence to Aguadulce there were long reaches of low undulation, with shallow, dead flat, lake-like basins on either hand around which the trail detoured. A dark-green water weed covered them, showing that they might be ponds during the rainy season.

"From Aguadulce the trail bore northeastward to Nata, passing to the left of an outlying clump of hills.

"Arrived over easy ground at Anton; we followed the trail to the beach and the beach to San Carlos; had not tide prevented would have followed it to the vicinity of Chame to make speed. It is the usual highway when tide permits. Much of the land along this part of the coast bluffs into the sea—clay bluffs 50 to 80 feet high, containing beds of rounded cobbles, and shingle cemented with clay, and standing vertical or nearly so.

"Capira Mountain, south of the river so named, is approached by way of a series of low saddles in spurs from the main cordillera. It necessitates an ascent of 550 feet and a descent of 331 feet to a crossing of the river. It exposes beds of clay rock harder than that found farther west, and is cumbered with blocks of the same material and boulders of volcanic origin. Heavy timber reappears in this locality.

"It is plain going from Capira River to Chorrera.

"Future expeditionary parties for survey between Punta Arenas and the Atrato country should be so timed, manned, and distributed as to complete the work in the summer season, say December to March, inclusive. This allows the month of November for drying the ground and carries nearly to the end of fair weather. Even in January and February we encountered hog wallows barely passable—some not passable—necessitating tedious detours. A few days' rain would have the effect of seriously impeding, if not actually blocking, field work. This memorandum is of great importance.

"The river Santa Maria flows eastward into the Gulf of Parita through a wide valley, receiving its principal tributaries from the southern slope of the cordillera. The Rio Grande, its neighbor eastwardly, appeared to draw its supplies direct from the interior of the Isthmus, which in that quarter looked much broken, hummocky, and comparatively low.

"Between Nata and Chame the oxhorn thorn abounded. It is chestnut-brown in color. Twin thorns alternate, 1 inch apart, on the stems and twigs of a shrub thinly foliaged, its leaves similar to those of the honey locust. The most perfect thorns have a height of  $1\frac{3}{4}$  inches, a spread of  $2\frac{3}{4}$  inches, and taper continuously on curved lines from an elliptic section at their juncture half an inch wide and a quarter deep. They curiously justify the name given them. Near the points a small hole is found in each thorn, permitting the passage of little reddish ants, who first consume the pith filling of the thorns and then inhabit the hollow. They discriminate unerringly between the push of the wind and that of hand, paw, or claw, and swarm out promptly to repel the intruder. Their bite is instant, multitudinous, and hot—somewhat like nettle sting, but the pain does not last long.

"In that same region, on saucered plains annually ponded by rain, were numerous abandoned ant hills, as we supposed, of a light granite-gray, having the appearance of cemetery monuments. They range from low cones 4 to 6 feet in diameter at the base and 2 feet high, through every variety, concave and convex in outline, of low cone surmounted by peaky cusp, the larger ones rising to heights of 8 and 10 feet above ground.

"Our march along the seaside between Anton and San Carlos was enlivened by the great company of pelicans—sometimes at rest on bowldery jetties, sometimes on the water, all of them taking wing when a shoal of fish appeared.

"The plains of Chame are of gray and white clay with disseminated shingle and cobbles, large beds of them scattered about. The surface of the country is clawed by drainage as if by spread fingers of an enormous hand struck in and gradually drawing together. The general surface is about 100 feet above the channels of the larger streams. Mist flowers were in blossom there, and morning glories, crimson, white, blue, and yellow, together with compound tints;

oxhorn thorns a plenty. Also climbing ferns, with very delicate little fronds, festooned the trees or hung withered in long tassels. North winds from the Caribbean Sea blew gusty during the forenoon. They were slackened in the afternoon by counter-currents from the Pacific, but prevailed again in the evening. The plains are diversified by islands and capes of low forest. There are few settlers between the Chame villages and Chorrera. The latter place is a summer resort about 20 miles from Panama—the largest town on our line between David and that city—its population a motley of Spanish, Indian, and negro.

“Approaching Panama we found many Jamaica negroes stranded by abandonment of work on the canal. Some of them were charcoal makers, others market gardeners; most of them ugly featured and rather surly in expression, but civil in speech and bearing, and in appearance thrifty.”—*Report of the Intercontinental Railway Commission, 1891–1893, Volume II.*

**RAILROADS**—*The Panama Railroad*.—“Mr. William Aspinwall and others obtained a charter from the State of New York on April 7, 1849, and undertook the construction of the Colon-Panama Railroad. The undertaking was beset by numerous difficulties, the more serious of which were the existence at the Atlantic end of some 6 miles of continuous swamp which had to be ballasted, the relatively high altitude of the Culebra Pass, over which the line was carried, and the prevalence of landslides at this latter point. Work was commenced toward the end of 1850, and it took the pioneers fully two years to complete barely 23 miles of road. Two years later they had advanced 20 miles farther to the Culebra Pass, and on January 27, 1855, the line was completed and inaugurated. Altogether its cost was some £1,600,000, or approximately £34,000 per mile.

“The concession granted to the company and the contract entered into between them and the Colombian Government in 1850 was, on August 16, 1867, or nearly thirteen years subsequent to the completion of the line, superseded by those under which the company is now working. By the terms of the present agreements the Colombian Government concedes to the company exclusive privilege for a term of ninety-nine years (expiring August 16, 1966) a practical monopoly of all roads across the Isthmus, the cession in perpetuity of 158,144

acres of waste lands (to be increased to 237,216 acres, if that quantity be disposable within the limits of the ancient provinces of Veraguas and Panama), the exemption of its properties from taxes of all and every description. In return for these concessions the company bound itself to pay the Colombian Government a sum of \$1,000,000 purchase money and an annual contribution of \$250,000, to transport gratuitously all national troops, equipage, arms, mails, and State-protected immigrants to the number of 2,000 per annum. At the expiration of the concession in 1896 the entire plant and annexes become State property. All the conditions of the concessions have been strictly observed.

"The company's plant consists of 26 road and 11 switch engines; 5 special, 8 first-class, 16 second-class, and 7 baggage cars; 580 box, 136 coal, and 183 flat freight cars; 57 other cars of various descriptions, 1 movable steam crane, and a pile driver; 3 steamships, with an average burden of 2,730 tons apiece; 3 steam tugs, and 24 lighters, with adequate mole and pier accommodation at both Colon and Panama; offices, stores, workshops, and a number of other edifices.

"The company has contracted to erect at a cost of \$1,000,000 a pier at the mouth of the river Grande, the Pacific outlet of the canal, a short distance to the west of Panama, with a view to permit the loading and unloading of cargo directly from a vessel to the cars. Dredging operations are being executed at this point, and with the removal of about 106,000 cubic feet of solid rock the channel leading up to the projected mole will be deep enough to admit the entry of such ocean-going ships as at present call in at this port. It is expected that the mole will be completed and open to traffic during the latter part of 1898. The actual size, 984 feet by 52½ feet, is wholly inadequate for present traffic, and when, as is asserted, only the open-sea side will be available for shipping, its value and importance sink into insignificance."—*Colombia, British Diplomatic and Consular Reports, 1896.*

BY RAIL FROM PANAMA TO COLON.—"The Panama Railroad has American rolling stock, 5 feet gage, and is a first-class line. All the engines and cars were manufactured in the United States.

"The railroad runs in a general northeasterly direction from Panama to the station of Corozal, 3.03 miles distant,

through a mangrove swamp. The capacity of the railroad siding at this station is 44 cars.

"From Corozal all the way to Culebra Station the railroad runs up grade.

"The next station, Rio Grande, is  $4\frac{1}{2}$  miles from Panama, and has no railroad siding whatever. The number of inhabitants, about 75, are principally Jamaica negroes.

"The next station of Miraflores is 5.5 miles from Panama, and has a railroad sidetrack, with capacity of 55 cars. Population, about 100, principally Jamaica negroes and Chinese.

"The next station, Pedro Miguel, is  $6\frac{1}{2}$  miles from Panama, and has a sidetrack capacity of 24 cars, also a good railroad water tank.

"The next station, Paraiso, 8 miles from Panama, is a place of probably 250 inhabitants, principally Jamaica negroes and Chinese.

"The next station of importance is Culebra, 11.2 miles from the city of Panama. Railroad sidetrack capacity at this place, 33 cars.

"The railroad company have a branch track running from near the railroad station, through Culebra Cut, along the canal, about 2 miles south.

"Near Culebra Cut about 200 frame houses are located, with corrugated iron roofs, belonging to the French Canal Company.

"At Culebra and at Empire, about  $1\frac{1}{2}$  miles north, the French Canal Company are at present working a force of about 900 Jamaica negroes on the canal line.

"Empire is a station 12.75 miles from Panama, having a side track along the railroad with a capacity of 45 cars. The French Canal Company also own about 50 frame houses, with galvanized roofs, where live the Jamaica negroes who are working upon the canal. The population is about 4,000.

"Near the town of Empire, about 400 yards east of the railroad station, is a hill about 251 feet in height, which is well intrenched and which was used by the revolutionists during the recent insurrection against Colombia to hinder the advance of the Government troops in their advance from Colon to Panama. A very strong defense was made by the revolutionists at this place.

"Las Cascadas, about  $14\frac{1}{2}$  miles from Panama, has a side

track of 36 cars and several large machine storehouses, belonging to the French Canal Company. Population about 400, principally Jamaica negroes and Chinese.

"Bas Obispo, the next station, is about 16.5 miles from Panama, with a side-track capacity of 9 cars. The number of inhabitants is about 200. At this point are also located a number of machine storehouses and frame houses belonging to the French Canal Company.

"Matachin is the next station, so called from the fact that during the time when the work was conducted on the canal by the French canal company in the year 1887 about 2,000 Chinese workmen who lived at this town died of yellow fever. This station is about  $17\frac{3}{4}$  miles from Panama, and has a side-track capacity of 98 cars; also a railroad water tank. The number of inhabitants is about 800, principally Jamaica negroes and Chinese.

"Gorgona is the next station, 19 miles from Panama, and has a sidetrack capacity of 21 cars. The population is about 3,000.

"Mamei is the next station,  $21\frac{1}{2}$  miles from Panama, and has a sidetrack capacity of 93 cars.

"The next station of importance is Tabernilla, 26 miles from Panama, having a sidetrack capacity of 41 cars. The number of inhabitants is about 200.

"The next station is Frijoles, about 29 miles from Panama. It has a railroad sidetrack capacity of 49 cars and a railroad water tank. Near the station are also located a number of machine storehouses of the French canal company.

"Bohio Soldado is the next station,  $32\frac{1}{4}$  miles from Panama, and has a sidetrack capacity of 70 cars. Population about 400, negroes and Chinese.

"The next station is Lion Hill, 37 miles from Panama, with sidetrack capacity of about 24 cars. The number of inhabitants is about 200, all blacks.

"Gatun is the next station,  $40\frac{3}{4}$  miles from Panama, with side-track capacity of 70 cars. This town has about 800 inhabitants, located on both sides of the Chagres River. Easy communication by means of small steamers can be had from this station to the coast. The river here is about 10 feet deep and 150 feet wide.

"Colon is the next town and the terminus of the Panama Railroad, located  $47\frac{3}{4}$  miles from Panama. In the city of

Colon the railroad company owns a large two-story office building near the railroad station. The side tracks of the railroad in this city have capacity of about 620 cars, while the side tracks of the railroad company in the city of Panama will accommodate 400 cars. There are good railroad water-tanks at both Colon and Panama.

"Culebra is the highest point on the railroad line and is about 300 feet above the level of the sea.

"The configuration of the country and the topographical features are well shown on the large map referred to, 'Carte de L'Isthme.'

"About 2 miles south of Colon, along the railroad, is a small station of five or six frame houses, near the foot of a small hill about 150 feet in height, known as 'Monkey Hill.' Artillery placed here would command all approaches to Colon from the south. It would also command the city of Colon, and, were the artillery of sufficient power, would command both the harbors of Manzanillo and Limon Bay.

"The north entrance to the canal is located about one-half mile west of Monkey Hill, and can be plainly seen from the top of the hill. All along the railroad and canal line between Colon and Panama the country is overgrown with a dense underbrush, rendering communication along the trails very difficult. There is no wagon road or cart road across the Isthmus, only a narrow trail 2 feet wide, with low-hanging vines and underbrush over head, quite impracticable during the rainy season for travel. There is absolutely no land communication from either Colon or Panama along the neck of the Isthmus with the interior of Colombia. The only communication had with Bogota or the interior of Colombia from the State of Panama is by steamship from Buenaventura Harbor on the west coast of Colombia to Panama, while the only communication on the Atlantic side is by a steamship from either Cartagena or Sabanilla.

"There is at present communication from Porto Bello Harbor across the Isthmus with Panama, by means of the old Spanish mule trail. This trail was at one time in very good condition, having been paved with cobblestone by the Spanish, but it is now in very bad repair, and during the rainy season almost impassable for mules and horses."—*Report of Capt. C. B. Humphrey, Twenty-second Infantry, 1903.*

“DESCRIPTION OF A TRIP BY THE PANAMA RAILROAD.— Leaving Colon, we crossed the embankment leading to the mainland, the Spanish Main of early writers. On our right there was an immense mangrove swamp, one mass of green; beyond the swamp was a little hill; then more lowland. The tropical jungle became thicker and thicker; in places it was so thick as to be absolutely impassable. Here and there were stretches of banana. These were interspersed with palms and other vegetation. Here and there a native hut could be seen on the hillsides. It was not long before we were at Gatun. To our right we caught a glimpse of the River Chagres, a peaceful stream in the dry season, but often, during the long wet season of the Isthmus, a huge, destructive volume of water. The railway there follows the left bank of the river as you approach the Pacific. Opposite the small station and just across on the opposite bank was the Indian hamlet of Gatun. In those days (1880) it was a mere collection of huts built of bamboos, thatched with palms or oleanders. We gradually approached the bridge of Barbacoas, 612 feet long. The river at this point in the dry season is a peaceful, shallow stream, perhaps 200 feet wide. During one of the floods of 1878 the valley of the Chagres was overflowed, and there were 12 to 18 feet of water over the railway. Beyond the bridge were trees, unfamiliar to me, and creepers in flower; orchids and palms also claimed attention. The great luxuriance and density of the vegetation, including palms, bamboos, and cottonwoods, became noticeable. The cottonwood especially, a huge tree with tremendous flanges at its base, is a characteristically tropic form of the native flora.

“Matachin is the midsection of the railway, and there the trains crossed. Not far from Matachin on the right is a once famous but now forgotten hill. It is named ‘Cerro Gigante,’ or the ‘Big Hill,’ and from its crest Vasco Nuñez de Balboa first saw the Pacific in the early morning of September 13, 1526.

“Culebra is the highest point of the railway, 238½ feet above the level of the Pacific. It is on the crest, or ‘divide,’ as it would be termed in the Rockies. The density of the vegetation may be gathered from the fact that rank grasses and undergrowth crowded down to the very rails. Men are constantly employed in cutting it away. It has been stated

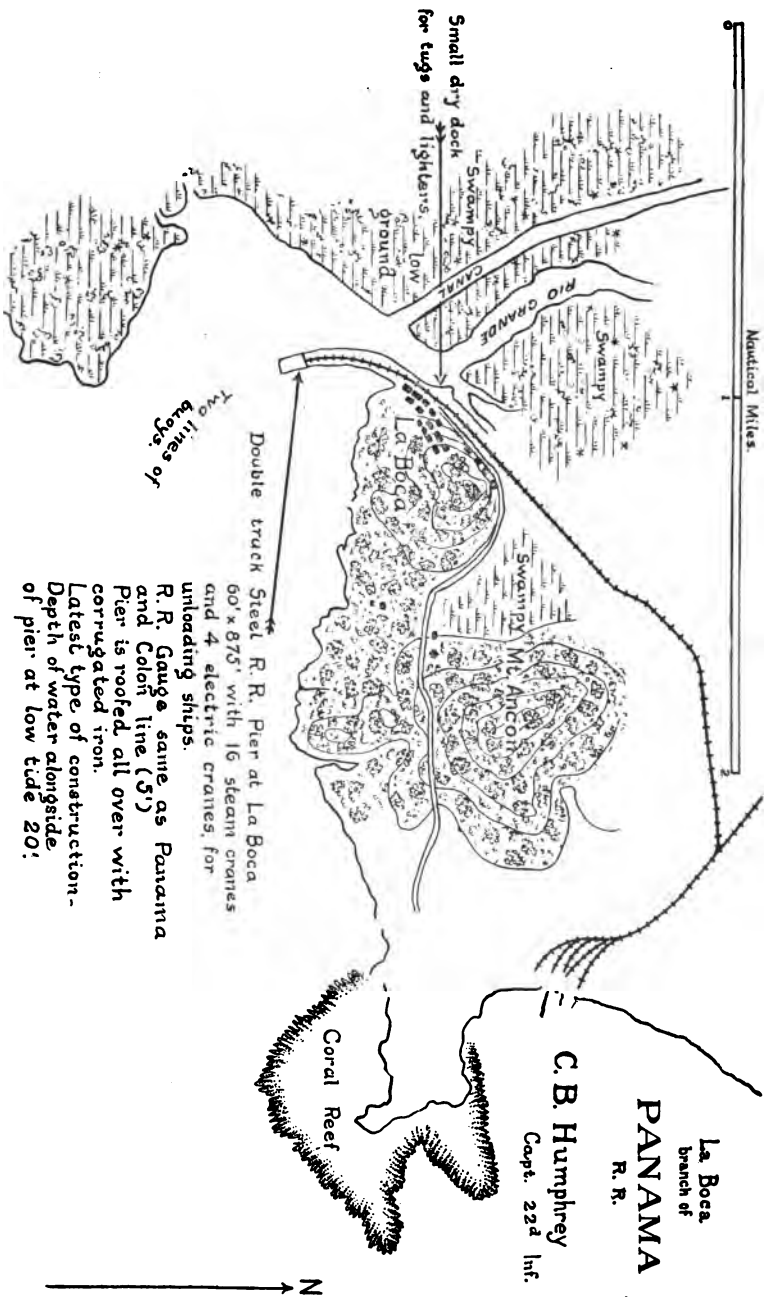
that if the Panama Railroad remained unused for six months the whole line would be grown over with tropical jungle. Having passed the crest, we commenced descending. In the distance we saw Mount Ancon, a small volcanic peak. It is just back of the city of Panama. Then we came upon more swamps and more mangroves and black soil. Here and there were great arms of the sea, or 'sloughs,' as they are termed in California. At high water they are filled; at low water they resemble great muddy ditches. They connect with the Rio Grande some 2 miles back of the city of Panama. Passing a small Indian village on the outskirts of Panama, we drew up in the station of the city."—*Descriptive Geography from Original Sources, by F. D. and A. J. Herbertson, 1902.*

"This very important connecting link between the Pacific and the Atlantic oceans has become a part of the assets of the Panama Canal Company, but it is operated under American charter (New York), a board of directors being kept in New York City for that purpose. The termini of the road are Colon on the Atlantic side and Panama on the Pacific. The length of the line is 47 miles, and there are 34 stations, to wit:

Station.	Distance from Colon.	Station.	Distance from Colon.
	<i>Miles.</i>		<i>Miles.</i>
Ch. Columbus.....	0.30	Bas Matachin.....	29.11
Monkey Hill.....	1.86	Matachin.....	29.97
Mindi.....	4.56	Bas Obispo.....	31.05
Gatun.....	6.60	Haut Obispo.....	31.94
Tiger Hill.....	8.17	Las Cascadas.....	33.11
Lion Hill.....	10.57	Empire.....	34.88
Ahorca Lagarto.....	12.70	Culebra.....	36.71
Bunji.....	15.45	Rio Grande Superior.....	37.30
Buena Vista.....	16.77	Cucaracha.....	37.97
Frijoles.....	18.77	Paraiso.....	39.09
Tabernilla.....	21.55	Pedro Miguel.....	40.34
Barbacoas.....	22.98	Pedro Miguel Tank.....	40.78
San Pablo.....	23.48	Miraflores.....	41.69
Ballamonos.....	24.45	Rio Grande.....	42.98
Mamci.....	25.86	Corozal.....	44.17
Juan Grande.....	27.46	Panama.....	47
Gorgona.....	28.60		

"Panama was not intended to be the Pacific terminus of the Panama Railroad. The road was to be built to Naos Island, some 3 miles farther away. It is at or near this island that all the steamers anchor, and the Pacific Mail Steamship Company has quite an establishment on it. By the terms of the concession the railroad forfeits annually \$30,000 to the department of Panama until the railroad

reaches Naos, or until vessels are enabled to discharge their cargoes on the main shore. Steps are now being taken to bring this about, the canal company intending to dredge the bay at the Pacific mouth of the canal (La Boca) so as to enable vessels of any size to enter, thus doing away with the expensive system of lighterage now in vogue here."—*Commercial Directory of the American Republics, 1897.*



La Boca  
branch of  
**PANAMA**  
R. R.

**C. B. Humphrey**  
Capt. 22d Inf.

12312—03—13



## Panama Railroad Company. Time-table No. 12.

[Taking effect 8 a. m., Sunday, September 14, 1902.]

South bound (read down).				Distance from Colon.	Capacity of sidings.	Stations.	Distance from Panama.	North bound (read up).			
Second-class.		First-class.						First-class.		Second-class.	
No. 7, freight, daily except Sunday.	No. 5, freight, daily except Sunday.	No. 3, mixed, daily.	No. 1, passenger and express, daily.					No. 2, passenger and express, daily.	No. 4, mixed, daily.	No. 6, freight, daily except Sunday.	No. 8, freight, daily except Sunday.
Leave. P. M.	Leave. A. M.	Leave. P. M.	Leave. A. M.	Miles.	Cars.		Miles.	Arrive. A. M.	Arrive. P. M.	Arrive. P. M.	
1.00	6.00	2.45	8.00	0	620	+ Colon†	47.65	10.45	9.30	4.25	
1.05	6.05	2.50	8.05 S	1.90	12	Mount Hope	45.75	10.35 S	9.20	4.16	
1.15	6.15	2.57	8.10 F	4.52	15	Mindí	43.13	10.24 F	9.06	4.03	
1.24	6.24	3.05 S	8.15 S	6.96	70	Gatun	40.69	10.18 S	8.57	3.57	
1.38	6.38	3.17	8.24 F	10.62	24	Lion Hill	37.03	10.08 F	8.50	3.45	
1.45	6.45	3.24 F	8.30 F	12.73	13	Ahorca Lagarto	34.92	9.56 F	8.45	3.40	
1.55	6.55	3.33 S	8.38 S	15.50	70	Bohío	32.15	9.50 S	8.38	3.33	
										3.38	
2.08	7.08	3.44	8.47 F	16.79		Buena Vista	30.86	9.40 F	8.08	3.05	
2.20	7.21	3.53 S	8.55 S	18.73	49	Frijoles†	28.92	9.30 S	7.58	2.55	
				21.60	41	Tabernilla	26.05				
				22.82	7	Barbacoas	24.83				
2.29	7.30	4.02 S	9.03 S	23.54	2	San Pablo	24.11	9.23 S	7.51	2.48	
		4.07	9.07 F	24.55		Bailamonos	23.10	9.19 F	7.43	2.40	
2.40	7.43	4.15 S	9.15 S	26.00	93	Mamel	21.65	9.15 S	7.38	2.35	
2.49	7.52	4.25 S	9.23 S	28.63	21	Gorgona	19.02	8.50 S	7.17	2.17	
2.52	7.55	4.30	9.30 S	30.02	98	+ Matachin†	17.63	8.47 S	7.10	2.10	
2.57	8.00	4.35 S	9.34 S	31.10	9	Bas Obispo	16.55	8.43 S	7.05	2.05	
3.01	8.04	4.36	9.41 S	33.13	36	Las Cascadas	14.62	8.38 S	6.57	1.57	
3.09	8.12	4.46 S	9.45 S	34.92	46	Empire	12.73	8.34 S	6.50	1.50	
3.21	8.26	4.55 S	9.50 S	36.44		Culebra	11.21	8.29 S	6.43	1.43	
3.26	8.34	5.01 S	10.00 S	37.53	33	Rio Grande Superior	10.07	8.27			
3.34	8.40		10.02	38.63		Paraiso	8.02	8.20 S	6.36	1.36	
3.46	8.52	5.13 S	10.10 S								

Panama Railroad Company. Time-table No. 12—Continued.

South bound (read down).				Distance from Colon.	Capacity of sidings.	Stations.	Distance from Panama.	North bound (read up).			
Second-class.		First-class.						First-class.		Second-class.	
No. 7, freight, daily except Sunday.	No. 5, freight, daily except Sunday.	No. 3, mixed, daily.	No. 1, passenger and express, daily.					No. 2, passenger and express, daily.	No. 4, mixed, daily.	No. 6, freight, daily except Sunday.	No. 8, freight, daily except Sunday.
Leave. P. M.	Leave. A. M.	Leave. P. M.	Leave. A. M.	Miles.	Cars.		Miles.	Arrive. A. M.	Arrive. P. M.	Arrive. A. M.	Arrive. P. M.
3.53	8.58	5.17 S	10.15 S	40.79	24	Pedro Miguel	6.86	8.17 S	3.03	6.20	1.20
4.01	9.06	5.20	10.20	41.33	15	Pedro Miguel Tank †	6.32	8.15	3.00	6.17	1.17
4.06	9.11	5.26	10.26 S	42.15	0	Miraflores	5.50	8.12 S	2.56	6.12	1.12
4.10	9.15	5.30	10.30	43.41	44	Rio Grande	4.24	8.09	2.53	6.09	1.09
4.20	9.25	5.35	10.35 F	44.62	400	Corozal	3.03	8.06 F	2.45	6.00	1.00
P. M.	A. M.	P. M.	A. M.	47.65		† Panama †	0	A. M.	P. M.	A. M.	P. M.
Arrive.	Arrive.	Arrive.	Arrive.					Leave.	Leave.	Leave.	Leave.
No. 7.	No. 5.	No. 3.	No. 1.	† Telegraph stations. ‡ Water tanks.				No. 2.	No. 4.	No. 6.	No. 8.

LA BOCA BRANCH.

South bound.				Stations.	North bound.			
No. 15.	No. 13.	No. 11.	No. 9.		No. 10.	No. 12.	No. 14.	No. 16.
Leave. P. M.	Leave. P. M.	Leave. A. M.	Leave. A. M.		Arrive. A. M.	Arrive. P. M.	Arrive. P. M.	
5.45	2.00	11.05	6.30		5.55	7.55	12.55	
5.53	2.08	11.13	6.37	300	5.47	7.47	12.47	
5.55	2.10	11.15	6.40		5.45	7.45	12.45	
M. ave.	P. M.	A. M.	A. M.		A. M.	A. M.	P. M.	
	Arrive.	Arrive.	Arrive.		Leave.	Leave.	Leave.	

LA BOCA BRANCH.

INTERCONTINENTAL RAILWAY.—“Any location that may be adopted for a railway along the Pacific slope of the Isthmus of Panama would, from the point of leaving Costa Rica to its attainment of the Atrato Basin, cross nearly at right angles most of the streams emptying into the great ocean. In their order, from west to east, the principal ones would be the Golfito, which empties into the Gulf of Dulce; the Chiriqui Viejo, the David, and the Tabasara, which discharge into the Gulf of Alanje; the San Pablo and San Pedro, into the Gulf of Montijo; the Santa Maria, into the Gulf of Parita; the Chepo, which is navigable for small vessels and empties into the Gulf of Panama; the Turia, the principal stream of the Isthmus, which discharges into the Gulf of San Miguel.”—*Report of the Intercontinental Railway Commission, Volume I, part 1, 1891–1898.*

A PROJECTED RAILROAD.—“A contract has been signed by the minister of the treasury of Colombia and Don Pablo Pinzon for the construction of a railroad to connect the district of Bocas del Toro and Chiriqui, in the department of Panama. The work is to be completed within ten years and the concessionaire is to receive from the Government a subsidy of 5,000 pesos per kilometer.”—*Monthly Bulletin of the Bureau of American Republics, July, 1899.*

CABLES.—Communication with the outside world is maintained at Colon by cable via Jamaica, and at Panama via Nicaragua and Mexico northward and Buenaventura southward.

TELEGRAPH.—Two telegraph wires along the railroad from Colon to Panama belong to the railroad and canal company separately. The telegraph offices along the route are: Gatun (2), Bohio (2), Frijoles (1), Taverniila (2), Mamei (1), Matachin (2), Empire (2), Paraiso (2), Rio Grande (1), Corozal (2).

### III. POPULATION.

#### (a) CENSUS, DISTRIBUTION, RACE, LANGUAGE, ETC.

"The inhabitants can hardly be classed as belonging exclusively to either of the three primal races. They are a curious mixture of red, white, and black—crude evidence of that lax morality which prevailed here in early Spanish colonial times. Just how these unfortunate people manage to live or why they never had the energy or ambition to better their condition nobody seems to know. Yet they are apparently happy in their life of poverty and wretchedness. They have few wants of body or mind. The indigenous plantain and banana afford a cheap and convenient substitute for bread, and fish from the streams and lagoons and a few yellow-legged chickens afford all the meat they want. Occasionally one sees an inferior specimen of the domestic pig or a forlorn-looking, half-famished donkey and sometimes a few domesticated ducks; but there are no cows or horses or other livestock, and one rarely sees a vegetable garden. Toward the Pacific coast the country is more thickly populated, the houses are better, the people look cleaner, healthier, stronger, and more self-respecting.

"The present population is perhaps 400,000, including an independent tribe of Indians, who are said to number about 8,000."—*The Colombian and Venezuelan Republics*. Scruggs, 1900.

"At present no group of Carib speech is known to inhabit any part of the Isthmus, although there are traditions that some of the warlike tribes in the central districts south of San Blas came originally from the Goajira Peninsula, which is still held by a powerful Carib nation. In recent years they have nearly all been absorbed in the general population—a mixture of Indians, whites, and mulattoes, in which the colored element is most pronounced. It is due to the large number of Jamaicans who were attracted to Panama by the high

rate of wages on the railway and canal works and many of whom afterwards settled in the country. The movement, unless arrested, must eventually assimilate the Isthmus to those parts of the Antilles where the African element predominates. In the eastern districts most of the aborigines, such as the Dariens or Papaparos, are extinct. But others, such as the Chocos, Queves, and Tules, still survive and constitute the Cuna family, whose affinities appear to be with the Chocos and Baudos of the Atrato and San Juan valleys in Colombia proper. (See table, Ch. III.)

“On the other hand, the Veraguas and Chiriquis, formerly dominant in the west, where they still form the bulk of the population, have abandoned the tribal system, with the associated usages and traditions, and are scarcely now to be distinguished from other Hispano-Americans of Spanish speech and culture. Nevertheless, they had, in pre-Columbian times, a culture of their own and thus formed a link in the chain of more or less civilized nations which extended, with interruptions, from the Pueblos of Arizona, through Mexico and Central America, into Colombia, Peru, and Bolivia.

“Like some of the neighboring Costa Ricans, the Veraguas of the auriferous district named from them were specially noted for their taste and technical skill in the goldsmith's art. Throughout the western section of the Isthmus, between the Chiriqui Inlet and Panama Bay, occur numerous prehistoric huacas (graves or barrows), which have yielded an abundance of gold and other artistic objects that had been deposited with the dead. Similar graves, some of large size, extend as far as the Gulf of Nicoya, but the objects found in them—obsidian, greenstone, and finely wrought jade tools and ornaments, knives, axes, armlets, rings, figures of men and gods, etc.—have been ascribed to Aztec influences, or even to the Aztecs themselves, who are now known to have ranged from Nicaragua into the adjacent parts of the present Costa Rica territory. Some of the barrows visited by Colonel Church in the district east of Guapiles are 100 feet long, 75 wide, and 15 high. ‘They appeared to be filled with broken statues of men, women, animals, and other objects sculptured from volcanic rock. We cut the weeds and exposed an immense statute, which must have been 10 feet high,’ besides ‘a fine life-size specimen of the head of an alligator and one of a

puma.' But no mention is anywhere made of architectural remains or of any monuments at all comparable to those of the Mayas or Incas. In this respect the culture of these Costa Rican and Panama people shows more affinity with that of the Colombian Chibchas, who were also famous jewelers and goldsmiths."—*Stanford's Compendium of Geography, Central and South America*.

"All along the railway from Colon to Panama are little towns and settlements, but few good houses. The habitations are thatched-roof sheds with dirt floors, and their inmates a curious mixture of red, white, and black. The indigenous plantain and banana afford a cheap and convenient substitute for bread, and fish from the streams and lagoons and a few yellow-legged chickens afford all the meat they want. There are no cows or horses or other live stock, and one rarely sees a vegetable garden.

"It is necessary to know their language and disposition to get along with the people. Civil and kind treatment almost assures civil and even courteous treatment in return. Touching their sensibilities or wounding their vanity should be avoided. Serious disturbances sometimes result from a mere thoughtless jest."—*The Colombian and Venezuelan Republics*.—*Scruggs*. 1900.

DESCRIPTION OF PEOPLE MET WITH ON A JOURNEY BETWEEN DAVID AND PANAMA.—"Our departure from David having occurred on a Saturday, we had our Sunday rest at Chorchá, a small Indian hamlet 12 miles out, pitching camp near the dwelling of Doctor Pecuado, an immigrant Cuban physician, who comes hither annually from Panama to pass the summer. Mr. Obaldia accompanied us and introduced us to that hospitable colony. The Pecuados were the only white residents. They straightway adopted us into the tribe, and in effect we slept at camp and ate with the family. The beautiful mother would take no excuses. The doctor's farm covered 450 acres of fertile prairie and bottom, half of it timbered. Land-hungry readers may be interested to learn that this fine estate cost him just 20 cents, the legal fee for making out papers. It is only 2 miles direct from salt water, but the crooked river channel across the sea flat necessitates a canoe voyage of three or four hours. He cultivates the plantain and the cacao chiefly. Said that monkeys lessened his crops, as they destroyed more than they ate. Had a tiger hide 5½ feet long from muzzle to rump; tail nearly 2½ feet.

"We made the acquaintance there of another transient guest, Señor José Santa María Jovenes, one of two young bachelor brothers, to whom we are indebted for courtesy. They have a cattle range, wire fenced, on the eastern side of Rio Fonseca, probably including 2 square miles. Their grant is a tract 12 by 60 miles in area, its boundaries not yet marked on the ground nor definitely described in writing or graphical plan. It is 47 square miles larger than the average size of counties in Pennsylvania.

"Near Remedios we met a party of wild Indians from the interior—thick-set, strong-legged fellows. Their faces were painted, as if with a fine camel's-hair brush, in thin, black lines, a diamond figure inclosing the mouth, three or four horizontal stripes across the nose, forehead, and cheeks in tit-tat-to diagram, no two alike, of which holiday set-off they betrayed a little conscious vanity. They answered our salutations with pleasant grins and friendly gestures.

"Agricultural Indians, speaking Spanish, peopled the country along the line of our survey through Chiriqui and Veraguas. In the provincial capitals, David and Santiago, whites may have outnumbered them. The field population was almost exclusively Indian. They were happily circumstanced. Numerous villages strung on the trail—singles and clusters, variously spaced like beads of a rosary—would remind Pacific voyagers of the coral archipelagos, each village an atoll with oval or circular prairie for lagoon, a girdling reef of cabins, then the all-surrounding woodland sea. Like their island cousins, before the paleface blasted them, they are for the most part in their first childhood as communities, sucklings of nature, to whom she bears a milkier bosom than to the Eskimo and Fuegian.

"Their cabins stand apart, within talking distance usually; clumps of mangoes and cocoanut in front, narrow plantations behind, similar to those of the French Canadians along the St. Lawrence, cleared from wilderness and sloping to brook or river—water convenient being a prime necessity. Perennial vegetation and a warm, equable climate, tempered by ocean winds, countervail the disadvantage of a soil but moderately rich. Cattle, horses, pigs, goats, and fowls feed at large. Every family is well housed, well fed, without toilsome labor, and the grown members well and cleanly clad; the wives tidy, robust, cheerful helpmates; the naked young broods

frisking like colts on the greensward. All villages alike are scenes of peace, welfare, and contentment.

"Their social economy, their generous hospitality, their good-fellowship, and neighborly virtues have come down to them, it is believed, not only from before the 'Conquest,' but from the period antedating a previous invasion, probably of Phœnician adventurers or immigrant warriors from Atlantis. These traits, as well as their features, color, and the antiquities of their country, bespeak them a race identical with our North American Indians, modified in some respects by an infusion of Semitic blood."—*Report of Intercontinental Railway Commission, 1891-1893, Vol. II.*

"THE TALAMANCANS.—Within less than 100 miles of where is contemplated the greatest interoceanic ditch the world has seen there dwells an Indian nation that is to all intents and purposes identically the same to day as it was when Columbus first discovered the Western Hemisphere. These are the Talamancans, who inhabit a few square miles in the mountains almost midway between the two oceans, and but a comparatively short distance from the Panama Railroad, though it is much to be doubted if they have ever seen it or are aware of its existence.

"For upward of four centuries the mediæval civilization of Spain has surrounded them on all sides, but their language is still their own and seems to have lost little of its original character through contact with the execrable mixture of English, Spanish, and French spoken by the lower classes throughout the West Indies and along the Spanish Main. As they live in virtually an unknown region, at least three days' journey from the nearest settlement, their solitude is seldom broken. The visitor is received with the greatest hospitality and is welcome as long as he desires to remain. Their visits to the outer world are infrequent, rarely extending beyond the nearest port; and are undertaken only in quest of luxuries.

"Extra fowls and porkers are bartered on these occasions for tobacco, geegaws, and ammunition. The spear and blow-gun are used more than firearms for various reasons. The former are not only infinitely cheaper, but usually more effective in the hands of the Indian than the cheap muzzle-loading fowling piece of French or German origin with its paper-like barrel—the only arm he can afford to purchase besides the machete.

"Their language and customs in some respects resemble those of the score or more of widely differing peoples that are scattered over the territory lying between the Mexican border and the Isthmus.

"Their ancestors doubtless served Aztec masters for centuries before Cortez appeared on the scene to impose a worse slavery upon them, for they are not of the superior race of which so many reminders in the shape of gold and silver ornaments, stone idols, and curious specimens of pottery have been unearthed in quantities in several of the Central American States, and being the opposite of warlike they could easily be held in bondage.

"They are not idolaters in any sense of the word, nor do they profess religion or hold public worship of any nature, though their belief tends more to fear of an evil spirit than faith in a good one; in fact, the Talamancans present an instance of a nation without a doctor, a lawyer, or priest, the 'sokee,' corresponding to the medicine man of the North American tribes, usually combining the functions of all three. Polygamy is the most important feature of their domestic relations, few, if any, of the members of the different tribes being content with less than three to half a dozen wives, while his Talamancan majesty might well exclaim with Launcelot, 'Alas! Fifteen wives is nothinge.' His seraglio is usually better provided in point of numbers.

"The government of this Indian nation is entirely hereditary, and it is astonishing to learn of the many points of the doctrine of primogeniture as practiced by the reigning families of Europe with which they are familiar. Their laws are naturally few in number, both the legislative and judicial power, as is usually the case where no fixed principles of either have been acquired, being vested exclusively in the king. In common with others in his position the world over, he is a despot, and rules according to royal whim where this does not conflict with long-established custom. The marital relation is held sacred. The engagement of a girl begins within a few hours of her birth, the bridegroom to be making a contract with the parents at that time. It is usually consummated when she reaches the age of 10 or 12, a custom that is responsible for great disparity in the age and longevity of the sexes.

"The needs of the Talamancan are primitive to a degree

characteristic of the early ages of man, and as nature provides for him with a bounteous hand his is an existence of dreamy contentment undisturbed by thought of the morrow or fear of the hereafter. The rivers teem with many varieties of edible fish, and game abounds to a degree unknown outside the Tropics, while the soil is so fertile as to give rise to the saying that it will raise pickaninnies. A little corn and cassava are planted, and the soil and climate do the rest. When they mature, which in the case of corn is four times a year, they are prepared in the same manner as that practiced by their forefathers from time out of mind. Clothing, whether for man or woman, is of the scantiest description imaginable, except on gala occasions or a visit to the settlement, when the trousers and shirt of civilization are donned by the former, the children running about absolutely naked until several years old.

"The Talamancan's hut, which is a masterpiece in the art of thatching, is a huge affair, and shelters his entire family and all his worldly possessions, including the domestic animals, that continually root around the interior during the day and retire with him at night. As he is a past master in the art of domesticating the wild deer, the peccary, the tapir, and even the tiger cat, numbers of these animals are present in every village, taking the place of the motley pack mongrels that usually greet the visitor at such humble settlements. His bed consists of the trunk of a certain species of palm, cut into strips and supported 3 or 4 feet from the ground on a frame, and a few earthen pots, with now and again an iron one, complete the furnishing of his house.

"While adept with the spear and deadly blowgun, in which various of the South American tribes employ poisoned darts, he is of the most peaceable nature, and his traditions contain no stirring tales of conquest, nor does his conversation boast of personal valor, for he knows not war. In short, the Talamancan is forever at peace with all the world, and only desires to pursue the even tenor of his way unmolested to the end of the chapter."—*Scientific American*, November 21, 1903.

## IV. RESOURCES.

### (a) MINERAL RESOURCES.

"Gold is obtained from the rivers Marca and Balsas, in South Darien. There still lives the tradition of the famous mines of Cana or Espiritu Santo, in the neighborhood of the Tuira. At one time they were called 'Potosi,' on account of the abundance and fineness of the ore produced. There are likewise gold mines in the neighborhood of the rivers Coclé, Belen, and Indias, and their tributaries. Of these the most noteworthy is that of San Antonio, on the Coclé, which is reported as yielding \$40,000 a year. Other mines are found at Las Tablas, Las Minas, El Mineral de Veraguas, Sona, Lovaina, Gualaca, and San Lorenzo.

"Salt is found in abundance throughout the department, and at many points its production is more profitable than that of gold.

"Copper is found near San Felix and near the road from David to Bocas del Toro. It exists also, there is reason for thinking, in the old province of Azuero.

"Iron is to be found in and about the Cerro de San Cristobal and in the ancient province of Azuero, according to indications.

"Coal is found near Las Bocas de Toro and in Golfo Dulce.

"Mineral waters are found in the districts of Santiago and Calobre, near the headwaters of the Changuinola, near the volcano at the foot of the Castillo Mount, near the Chiriqui River, in the Mendez Ranch, near the Yeguas Pass, in Pan de Azucar, and on the banks of the Gallequi River, near San Felix.

"Pearls are found not only in the Archipelago de las Perlas, but in many other spots on the sea bottom, which would seem to be almost covered with these precious stones. As many as one million shells a year are said to be secured by divers, and though all do not contain pearls they are available as mother-of-pearl.

"Chalk and lime also abound in various parts of the department."—*Colombia. Bureau of American Republics, 1892.*

"In the early days of the Panama Railroad, and later, during the canal construction period, numerous efforts were made to explore the coal regions of the Atlantic in near proximity to the ports of Colon and Panama. These researches led up to the discovery of bituminous shales and lignite near the port of Boca del Toro on the Caribbean Sea. Some hopes had been entertained that these deposits would give valuable coal, but an examination and analysis have convinced me that the veins are too small and the percentage of carbon too low to justify any expectation from this source. The largest vein I saw was about 3 feet thick, and the analysis gave—

Carbon .....	40.181
Water .....	12.962
Ash .....	30.216

"It will be seen at a glance that the coal has no commercial value, especially as some of the carbon was infusible and noncombustible graphite. Considerable work was done at these mines some years ago, but little signs of the excavations now remain, the opening being filled with débris washed in by the waters of the rainy season. These deposits do not cover an area of over 10 miles, and are not worthy of more than passing mention.

"On the Pacific, coal measures expose themselves near Punta Burica, in Colombia, and the peninsular projection that forms the northern inclosure of Golfo Dulce, in Costa Rica. The numerous small streams that flow into the gulf from the cordillera, on the boundary of Colombia and Costa Rica, bring down fragments of lignite and coal, showing that they pass through large carboniferous deposits.

"Some work was attempted in these regions (judging from openings that are now nearly filled in with débris) many years ago, but evidently with meager results, owing to the fact that the exploring party did not enter sufficiently far into the interior to reach a healthy carboniferous formation. I consider it feasible to mine good coal in these regions at a distance of from 15 to 20 miles from the coast, as the crop-pings I examined at several points show veins from 3 to 6 feet thick of bituminous coal embedded in lignite and shale.

"The carboniferous measures of this locality cover an area of about 100 square miles, and are about equal to the coal beds of Chesterfield County, Va.

"This disposes, as far as I have investigated, of the coal beds of Panama, with the exception of those of Rio Chucunaque, about 12 miles northwest of Point Mosquito."—*Monthly Bulletin of the Bureau of American Republics, 1893-94. Special Bulletin, November, 1893.*

(b) **TIMBER AND FUEL.**

"The department yields woods of excellent quality and colossal growth, principally in South Darien, though they abound also in the mountains along the coasts and in the islands of both seas. The following may be named: Cacique, corotú, and espavé, fit for shipbuilding, and not infested by any sort of insect whatever; caimito, hueso, cerezo, macano, madroño, naranjillo, bola, and laurel, excellent for polished work and building, as are also the mora and guayacan, which are, furthermore, incorruptible; níspero and espinoso, which make the best boarding known; mahogany (black, red, or veined), rosewood, rosilla, quira, cocobobo, and roble amarillo (yellow oak), which do not rot; roble comun (common oak), adapted for ship timbers; el manzanillo (manchineel), a building and cabinet wood; jicarrillo, and espino amarillo.

"Among furniture woods may be named the cedars known as cebolla, espina, real, and papaya, all of excellent quality and exempt from the attacks of the 'comejen' (timber worm); amarillo de Guayaquil, which is incorruptible; algarrobo del Perú, ijagua de montaña, alcornoque, chuchipate, and chachojo, all very useful for building; maderon, very durable and available for inlaid work; alfahillo, the same; tanjiro, similar to mahogany; jigna blanca, jigna negra, saponario, the leaves and bark of which are used as soap; majagua, used by the Indians for making ropes; palo de lana (wool-tree), similar to the ceiba or silk-cotton tree, and which grows to a height of more than 100 feet, and is used for canoes; hobo, a durable and colossal tree; bongo and balso, trees of considerable thickness, but very light, resembling cork, and used for making rafts; yaya, very durable; mangle, cavalero, pena, salado, and colorado, the last very durable and suitable for shipbuilding; culuba, much used for making mats, etc.; gachapalá and maría, good for masts; murciélagos, hobo de

puerco (é de cerco), barigon, haya, raton, carcún, sibo, and terciopelo, all useful to carpenters, as are also the guayabito de montaña, cerezo silvestre (wild cherry), pavo, mostrenco, and conaza.

"The following woods used for making dyestuff are found in the department: Uvilla, curtidora, divi-divi, dragon's blood, tuno, mulberry, Brazilian wood (brasilete), igua, aguacate colorado, guayacan, anil amarillo de yuca, carocolito (purple shell), muqueva, ojo de venado (black), tagua de montaña (indelible carmine), and nazareno (purple)."—*Colombia, Bureau of American Republics*.

#### (c) **ANIMAL RESOURCES.**

It is reported that mules may be obtained in numbers and in localities and in one week's notice, as follows:

Pedregal .....	100
Puerto Mutis .....	30
Mensable .....	50
Aguadulce .....	50
Chepo .....	10
Chorrera .....	10
Panama .....	50

—*Report of Capt. C. B. Humphrey, Twenty-second Infantry, 1903.*

#### (d) **PRODUCTS AND MANUFACTURES.**

"The department produces cloves equal in fragrance to those of Ceylon; palosanto, from which is obtained the famous balsam maria; copaiba, caucho, almáciga (mastic), copachí, chutra, caraña, cabima, cateba, croton, palo de sangre, saumedio, jigucanelo, bálsamo de drago, chiriquí, chinchire, tustele (yielding rubber, like the caucho), and palo de vaca.

"Honey and beeswax are produced in great abundance.

"The following fruits and vegetables are produced on the Isthmus, both wild and in cultivation:

"Aguacate, cacao, coco, pomaroda, mango, mamei del pais, naranjo dulce, naranjo agrio, limon, torovijo, marañon, guanábano, membrillo (quince), guayabo zapote, brevo, hicaco, anon, hagua, ñame, uvito guagabilla, calanva, níspero, cerezo, higo (figs), caimito, higo chumbo, granado, papayo, sabio,

granadillo, ciruela (plum), guate, curubo, piño, piñuelo, sapoya, cerenjena (eggplant), tomate (tomatoes), melon, sandia, calabaza dulce (squash), and eight sorts of aji (capsicum).

"Among the palms of Panama we may note the wine palm, the oil palm, the corozo, the royal, the chontadura, the umbrella palm, the cabeza de negro palm, the taparro, and the cocoa palm, which is remarkable not only for its fruit, but for being planted around settlements to protect houses from lightning, as it serves as a very efficient sort of lightning rod."—*Colombia, Bureau of American Republics*.

"While coffee is being grown everywhere in the department, yet, according to the practical study and experience of a Costa Rican, you find the land in the province of Coclé to be the best fitted for the cultivation of this most precious grain.

"Cocoa has a great future in the Isthmus, and there are already some valuable plantations under cultivation—rubber, ivory nuts, cabinetmakers' wood, wood for dyeing purposes, mother-of-pearl and tortoise shell, sarsaparilla, ipecacuhana, leathers and skins of different kinds.

"The tobacco produced is of excellent quality, but its production hardly suffices for home consumption.

"Sugar-cane products and the breeding of domestic animals constitute the principal riches of Chiriqui, Los Santos, Coclé, and Veraguas. They lend themselves to the cultivation of sugar cane, however, with great ardor, which promises such valuable returns through its products. The same can be said of the cereals belonging to their zone, which up to the present time is cultivated for interior consumption."—*Directory of Panama, 1898*.

"Ice, formerly imported from the United States, is now manufactured in Panama, where machinery with a maximum product of about 10 tons per day has lately been established. The ice is of poor quality, because of an imperfect and filthy water supply, and is sold at the high price of 5 cents silver (1½d.) per pound. Frequent interruptions in the service of this important commodity have occurred during the year, and many complaints are consequently heard in the community."—*Colombia, British Diplomatic and Consular Reports, Report for the year 1890 on Panama*.

(e) **REVENUES.**

**TAXES, ETC.**—"Previous to 1880 the Panama Railway had been paying to Colombia an annual revenue of 225,000 pesos gold, but in that year the income was anticipated up to March 27, 1908."

**EXPORTS AND IMPORTS.**—"There is an important transit trade passing between the two ports of Panama and Colon. In 1900 the weight of goods transported westward by rail was 153,758 tons, of which 60,518 tons was from New York, 54,905 tons from Europe, and the remainder was in local traffic.

"The weight carried eastward was 203,619 tons, of which 118,670 tons was to New York, 77,219 tons to Europe, and the rest was in local traffic."—*Statesman's Yearbook*, 1903.

"The export trade of the Department of Panama showed an advance for 1898 over 1897 of 19 per cent. The items showing the greatest percentage of increase are rubber, mahogany, ipecacuanha, cocobolo, medicinal balsams, bananas, and tortoise shells. The total value of the articles sent to the United States was \$777,792.69. Besides the articles named the following are included: Cacao, cocoanuts, coffee, raw hides, skins, ivory nuts, and mother-of-pearl shells. Exports to other countries amounted to \$131,733.66; to Great Britain, \$103,777.09; Germany, \$19,437.30, and France, \$8,519.27.

"From Bocas del Toro, the seat of the banana industry, 2,029,021 racimes (bunches) of plantains were sent to the United States in 1896. The value of this product at the port of shipment was \$405,804. The fruit is conveyed from Barranquilla in small United States steamers to the markets of Mobile and New Orleans, the round trip being made in twelve days. Fifteen firms in Barranquilla, which has a population of 10,000, deal in bananas. From Barranquilla the exports amounted to \$9,280,356.53, an increase over 1897 of \$670,303.57. The most important industry in this section is the manufacture of soap by two factories equipped with the latest appliances. A Spanish firm recently erected a modern candle factory and has a good demand for its goods. Other industries are several distilleries, an iron factory, two tanneries, with a monthly output of 3,000 hides, and a number of brick kilns and tile factories."—*Monthly Bulletin of the Bureau of American Republics*, June, 1899.

“The exportation of products has commenced to be quite considerable in the Isthmus. Recent statistics demonstrate that the exportations equal one-half more or less of the importations of the department.

“The exports are very varied and rich, commencing with gold, but the present revenue statistics finds silver at the head, which is exported on a large scale from the northern shores, especially those of the rich and flourishing district of Bocas del Toro.”—*Directory of Panama, 1898.*

## V. MISCELLANEOUS INFORMATION.

TABLE SETTING FORTH THE TERRITORIAL, POLITICAL, FISCAL, JUDICIAL, ECCLESIASTICAL, ELECTORAL, NOTARY AND REGISTRY DIVISIONS, ETC., OF THE DEPARTMENT OF PANAMA, FORMED IN ACCORDANCE WITH THE LAWS, DECREES, AND REGULATIONS IN FORCE.

### A. *Provinces of the department (political and fiscal).*

[Directory of Panama.]

Names of the provinces and municipal districts.	Distance to the city of Panama.	Distance to the city of Bogota. <sup>a</sup>	Mayoralties.
<b>COLON</b> (capital, Colon):	<i>Miriame- ters.<sup>b</sup></i>	<i>Miriame- ters.<sup>b</sup></i>	
1. Bocas del Toro .....	62.08	160	Chiriqui Grande, Bastimento, Bocas del Drago, Bocas del Toro.
2. Buenavista .....	5.03	142.3	Tabernilla, Ahorca Lagarto, Buenavista, Caimito Mulato.
3. Colon .....	8.63	139	Monkey Hill, Majagual, Playa Flor.
4. Chagres .....	8.07	139.5	Lagarto, Salud y Río Indio.
5. Donoso .....	( <sup>c</sup> )	( <sup>c</sup> )	
6. Gatun .....	7.25	139.2	Jamaiquita.
7. Portobelo .....	10.05	134	Nombre de Dios, Palenque.
<b>COCLE</b> (capital, Penonome):			
1. Aguadulce .....	18.25	165.5	Pocri.
2. Anton .....	15.25	162.5	
3. La Pintada .....	18.05	165.3	
4. Nata .....	17.08	165.1	
5. Ola .....	19.08	167.1	
6. Penonomet .....	17.03	164.6	Cocle, Paloverde, Río Grande, Tuabre.
<b>CHIRIQUI</b> (capital, David):			
1. Alanje .....	52.25	199.6	
2. Bugaba .....	53.45	200	
3. David .....	50.55	197.8	Pedregal, Bajo Boquete, San Pablo.
4. Dolega .....	52.35	198.6	
5. Gualaca .....	50.35	198.1	
6. Los Remedios .....	40.08	188	
7. San Felix .....	42.04	189.7	
8. San Lorenzo .....	45.08	193.1	
9. Tole .....	57.03	184.6	
<b>LOS SANTOS</b> (capital, Pese):			
1. Chitre .....	25.56	172.8	
2. Guarare .....	28.14	175.4	
3. Las Minas .....	27.85	175.15	
4. Las Tablas .....	28.08	176.1	
5. Los Santos .....	25.65	172.8	
6. Macaracas .....	29.45	176.4	
7. Ocu .....	26.03	173.6	
8. Parita .....	23.85	171.1	
9. Pedasi .....	32.02	179.5	
10. Pese .....	25.25	172.5	Paritilla.
11. Pocri .....	30.01	177.4	
12. Santa Maria .....	21.55	168.8	
13. Tonosi .....	29.90	177	
<b>PANAMA</b> (capital, Panama):			
1. Arraijan .....	2.02	149.6	Cocoli, Farfan.
2. Balboa .....	8.05	( <sup>c</sup> )	San Miguel, Chiman, Saboga.
3. Capira .....	6.25	153.5	El Potrero, Cerneno.
4. Chame .....	8.75	156	
5. Chepo .....	7.00	154.3	Corozal, El Llano.
6. Chorrera .....	3.75	151.05	
7. Chepigana .....	20.75	168	Chepigana, La Palma, Garachiné, Jaqué, Jurado, Tucuti.
8. Emperador .....	.25	147.05	Culebra, Paraiso y Pedro Miguel, Cascadas y Casas Blancas.

<sup>a</sup> Via Cartagena.

<sup>b</sup> 1 miriometer equals 6.2138 English miles.

<sup>c</sup> No data.

A. *Provinces of the department (political and fiscal)*—Continued.

Names of the provinces and municipal districts.	Distance to the city of Panama.	Distance to the city of Bogota.	Mayoralties.
<b>PANAMA</b> —Continued.	<i>Miriame- ters.</i>	<i>Miriame- ters.</i>	
9. Gorgona .....	3.75	142.5	Alto y Bajo Obispo, Matachin, Mamey y Baillamonos, San Pablo, Cruces.
10. Panama .....	.00	147.3	Pueblo Nuevo, Naos, La Boca, Pacora.
11. Pinogana .....	18.07	165.3	Cana, Pinogana, Yaviza, El Real de Santamaria.
12. San Carlos .....	10.05	157.8	
13. Taboga .....	1.75	149.05	Otoque.
<b>VERAGUAS</b> (capital, Santiago):			
1. Calobre .....	21.03	163.6	
2. Canazas .....	25.03	172.6	
3. La Mesa .....	27.08	175.1	
4. Las Palmas .....	31.08	179	
5. Montijo .....	26.65	173.9	Coibita.
6. Rio Jesus .....	27.95	175.2	
7. San Francisco .....	22.09	170.2	
8. Santa Fe .....	36.03	183.3	
9. Santiago .....	25.03	172.35	Atalaya.
10. Sona .....	30.08	178.1	

B.—*Judicial circuits and sections.*

<b>BOCAS DEL TORO</b> (capital, Bocas del Toro):	<b>LOS SANTOS</b> —Continued.
Bocas del Toro, con los corregimientos de Chiriqui Grande.	5. Los Santos.
Bastimentos, Bocas del Drago y Bocas del Toro.	6. Macaracas.
<b>COLON</b> (capital, Colon):	7. Ocu.
1. Buenavista.	8. Parita.
2. Colon.	9. Pedasi.
3. Chagres.	10. Pesé.
4. Donoso.	11. Pocri.
5. Gatun.	12. Santa Maria.
6. Portobelo.	13. Tonosi.
<b>COCLE</b> (capital, Penonome):	<b>PANAMA</b> (capital, Panama):
1. Aguadulce.	1. Arraijan.
2. Anton.	2. Balboa.
3. La Pintada.	3. Capira.
4. Nata.	4. Chame.
5. Ola.	5. Chepo.
6. Penonome.	6. Chorrera.
<b>CHIRIQUI</b> (capital, David):	7. Chepigana.
1. Alanje.	8. Emperador.
2. Bugaba.	9. Gorgona.
3. David.	10. Panama.
4. Dolega.	11. Pinogana.
5. Gualaca.	12. San Carlos.
6. Los Remedios.	13. Taboga.
7. San Felix.	<b>VERAGUAS</b> (capital, Santiago):
8. San Lorenzo.	1. Calobre.
9. Tolé.	2. Cñazas.
<b>LOS SANTOS</b> (capital, Pesé):	3. La Mesa.
1. Chitré.	4. Las Palmas.
2. Guararé.	5. Montijo.
3. Las Minas.	6. Rio Jesus.
4. Las Tablas.	7. San Francisco.
	8. Santa Fe.
	9. Santiago.
	10. Sona.

C.—*Educational provinces.*

Municipal districts forming the provinces.	Rural schools in the municipal districts.
<b>COLON</b> (capital, Colon):	
1. Bocas del Toro.....	Chiriqui Grande y Bastimentos.
2. Buenavista.....	
3. Colon.....	Playa de Flor.
4. Chagres.....	Lagarto.
5. Gatun.....	
6. Portobelo.....	Palenque, Viento Frio y Nombre de Dios.
<b>COCLE</b> (capital, Penonome):	
1. Anton.....	El Valle.
2. Aguadulce.....	Pocri y El Cristo.
3. La Pintada.....	
4. Nata.....	
5. Ola.....	
6. Penonome.....	Rio Grande y Toabre.
<b>CHIRIQUI</b> (capital, David):	
1. Alanje.....	
2. Bugaba.....	Boqueron Pedregal, Las Lomis y San Pablo.
3. David.....	Tinajas.
4. Dolega.....	
5. Gualaca.....	
6. Los Remedios.....	
7. San Felix.....	
8. San Lorenzo.....	
9. Tolé.....	
<b>LOS SANTOS</b> (capital, Pesé):	
1. Chitre.....	
2. Guararé.....	
3. Las Minas.....	
4. Las Tablas.....	
5. Los Santos.....	La Palma.
6. Macaracas.....	
7. Ocu.....	
8. Parita.....	
9. Pedasi.....	
10. Pesé.....	
11. Pocri.....	Paritilla.
12. Santa Maria.....	
13. Tonosi.....	
<b>PANAMA</b> (capital, Panama):	
1. Araján.....	Chiman.
2. Balboa.....	Cermeno y El Potrero.
3. Capira.....	Bejuco.
4. Chame.....	
5. Chepo.....	
6. Chorrera.....	La Palma.
7. Chepigana.....	Culebra, Paraiso.
8. Emperador.....	Matachin y Ballamonos.
9. Gorgona.....	Pacora.
10. Panama.....	Santa Maria, Garachiné y Yaviza.
11. Pinogana.....	
12. San Carlos.....	
13. Taboga.....	
<b>VERAGUAS</b> (capital, Santiago):	
1. Calobre.....	
2. Cañazas.....	
3. La Mesa.....	
4. Las Palmas.....	
5. Montijo.....	
6. Rio Jesus.....	
7. San Francisco.....	
8. Santa Fe.....	
9. Santiago.....	La Colorada..
10. Sona.....	

*D. Notary and registry circuits.*

BOCAS DEL TORO (capital, Bocas del Toro):

1. Bocas del Toro.

COLON (capital, Colon):

1. Buenavista.
2. Colon.
3. Chagres.
4. Donoso.
5. Gatun.
6. Portobelo.

COCLE (capital, Penonome):

1. Aguadulce.
2. Anton.
3. La Pintada.
4. Nata.
5. Ola.
6. Penonomé.

CHIRIQUI (capital, David):

1. Alanje.
2. Bugaba.
3. David.
4. Dolega.
5. Gualaca.
6. Los Remedios.
7. San Felix.
8. San Lorenzo.
9. Tolé.

LOS SANTOS (capital, Pesé):

1. Chitre.
2. Guararé.
3. Las Minas.
4. Las Tablas.
5. Los Santos.
6. Macaracas.

LOS SANTOS—Continued.

7. Ocu.
8. Parita.
9. Pedasi.
10. Pesé.
11. Pochi.
12. Santa Maria.
13. Tonosi.

PANAMA (capital, Panama):

1. Arraijan.
2. Balboa.
3. Capira.
4. Chame.
5. Chepo.
6. Chorrera.
7. Chepigana.
8. Emperador.
9. Gorgona.
10. Panama.
11. Pinogana.
12. San Carlos.
13. Taboga.

VERAGUAS (capital, Santiago):

1. Calobre.
2. Cañazas.
3. La Mesa.
4. Las Palmas.
5. Montijo.
6. Rio Jesus.
7. San Francisco.
8. Santa Fe.
9. Santiago.
10. Sona.

*Population electoral circuits or districts, 1870.***COLON (capital, Colon):**

1. Bocas del Toro .....	5,250
2. Buenavista .....	1,458
3. Colon .....	8,248
4. Chagres .....	1,277
5. Donoso .....	2,908
6. Gatun .....	606
7. Portobelo .....	10,531

30,271

**COCLE (capital, Penonome):**

1. Aguadulce .....	3,074
2. Anton .....	2,792
3. La Pintada .....	5,711
4. Nata .....	5,888
5. Ola .....	3,756
6. Penonome .....	12,687

33,888

**CHIRIQUI (capital, David):**

1. Alanje .....	7,487
2. Bugaba .....	1,059
3. David .....	9,613
4. Dolega .....	3,407
5. Gualaca .....	2,413
6. Los Remedios .....	1,538
7. San Felix .....	2,230
8. San Lorenzo .....	2,909
9. Tolé .....	2,384

32,440

**LOS SANTOS (capital, Pesé):**

1. Chitre .....	2,378
2. Guararé .....	1,472
3. Las Minas .....	2,761
4. Las Tablas .....	5,047
5. Los Santos .....	4,023
6. Macaracas .....	3,199
7. Ocu .....	3,321

**LOS SANTOS—Continued.**

8. Parita .....	2,551
9. Pedasi .....	4,182
10. Pesé .....	3,318
11. Pocri .....	3,302
12. Santa Maria .....	2,264
13. Tonosi .....	1,500

39,318

**PANAMA (capital, Panama):**

1. Arraijan .....	1,319
2. Balboa .....	3,220
3. Capira .....	1,501
4. Chame .....	1,961
5. Chepo .....	3,157
6. Chorrera .....	4,834
7. Chepigana .....	3,716
8. Emperador .....	1,420
9. Gorgona .....	2,564
10. Panama .....	16,406
11. Pinogana .....	3,715
12. San Carlos .....	2,084
13. Taboga .....	1,568

47,415

**VERAGUAS (capital, Santiago):**

1. Calobre .....	3,670
2. Cañazas .....	3,824
3. La Mesa .....	3,561
4. Las Palmas .....	2,691
5. Montijo .....	1,800
6. Rio Jesus .....	2,027
7. San Francisco .....	3,471
8. Santa Fe .....	3,508
9. Santiago .....	9,219
10. Sona .....	3,439

37,210

Total..... 220,542

*Towns and localities connected by the telegraph.*—Aguadulce, Anton, Arraijan, Capira, Chame, Chitre, Chorrera, David, Guararé, Horconciotos, Las Lajas, La Mesa, La Pintada, Las Palmas, Los Santos, Las Tablas, Nata, Ocu, Panama, Parita, Penonomé, Pedregal, Pesé, Remedios, Santiago, San Carlos, San Felix, Santa Maria, San Lorenzo, Sona, Tolé.

“An advance across the Isthmus from Colon toward Panama would be, of course, easiest by the railroad line, as the trails are all generally very difficult and overgrown with brush. There is a telegraph and telephone line which runs across the Isthmus along the railroad. The railroad is ballasted with rock nearly the whole distance from Colon to Panama. Light artillery could be taken along the railroad on trains or could be taken along the railroad track, when the necessary amount of boards and planks would have to be carried to lay over the bridges. Three equipped men on foot could march abreast along the railroad line.

“There is water communication from the mouth of the Chagres River to Gatun, which has already been spoken of.

The railroad is generally straight, with no more than the ordinary number of curves. Vegetation on both sides of the track grows most luxuriantly, there being a great many bamboo and banana trees.

"There are several hills which could be occupied to prevent advance along the line. The railroad is quite well equipped with plenty of rolling stock. There are about 65 bridges, principally steel, the most important and longest crossing the Chagres River at Gatun.

"About 150 small cart mules and horses could be obtained in the city of Panama; about 75 pack mules could be obtained in Chorrera, while not more than 50 or 60 animals could be obtained in the city of Colon.

"Guns mounted upon a point near the light-house in the city of Colon could protect both harbors against a hostile fleet. Fresh water is obtainable at Colon for vessels, but is of poor quality.

"About one-half mile west of the city of Panama is a large hill about 600 feet in height (Ancon). On the northeast side of this hill are located large hospital buildings of the French Canal Company. This hospital has 18 wards, each ward having 40 beds, and has very modern equipment. The drainage system, however, is not very well arranged, and at present the sanitary condition of the hospital is not good. Modern artillery could be placed upon this hill and command the city of Panama and both the harbors, also the anchorage near the island of Culebra. Other hospitals are the Hospital de Estrangeros, having room for 75 patients, and the Hospital of Santo Tomas, with 11 nurses, Sisters of Charity.

"The only points where troops could be landed near Colon on the Atlantic side of the Isthmus are Portobelo Harbor, Manzanillo or Limon Bay, at Boca del Toro, or in favorable weather at the mouth of the Chagres River. The only place where troops could be landed on the south side of the Isthmus is at the harbor of Panama or La Boca, or at the mouth of the Camito River near Chorrera."—*Report of Capt. C. B. Humphrey, Twenty-second Infantry, 1903.*

THE INTERIOR.—"Although in the search of a practicable canal route from the Atlantic Ocean to the Pacific, the Isthmus of Panama has been considerably explored transversely, it would appear that longitudinally it has not received the same attention. Thus, while we learn that between Chepo

on the south and the Gulf of San Blas on the north the Isthmus narrows to a minimum width, that the summit of the Cordillera reaches an altitude of but 1,500 feet, and incidentally that the Indians are numerous, warlike, and hostile; while from Cullen we learn that the Cordillera is reduced to a height of 350 feet between Caledonia Bay and the Savana River, and that the ridge here is but 2 miles wide at its base, falling away on both sides in level plains (statements proven to be erroneous by Selfridge); and while again we are informed that by following the course of the Tuira River we shall be led to a portage to the Atrato River of but 3 miles in length and 400 feet in height—while we are furnished with reports like these derived from journeys *across* the Isthmus, we look in vain for accounts of exploration *lengthwise* of this neck of land. Roads or trails there appear to be none. In the interior tropical growth, jungle, thicket, and swampy morass abound. The Cordilleras are irregular and difficult, few towns exist, and the Indians, in some localities at least, are unconquered, savage, and hostile. With such obstacles to overcome, it would seem on the whole that the interior of the Isthmus presents almost if not quite insuperable difficulties to extensive and continuous exploration or passage along its length.”—*Compiler*.

#### PUBLIC INSTRUCTION.

“While public instruction in the department leaves much to be desired, yet its progress is slow but sure. The great obstacle is the lack of competent teachers.

“The secretary of public instruction, in his report of the year 1898 to the governor of the department, states that elementary schools are springing up, one by one, throughout the entire department, but that it is of greater importance to produce good instructors than to multiply primary schools. With this end in view the normal school for teachers was founded in May, 1897, which is doing a promising work under the direction of two distinguished ladies, Doña Matilde and Doña Rosa Elena Rubiano C., who were brought from the capital of the Republic expressly for that purpose.

*Educational statistics for 1896 and 1897.*

	Pupils registered.	Pupils in attendance.
1897 .....	6,592	4,006
1896 .....	5,421	3,636
Increase of 1897 .....	1,171	370
Further increase in 1897 by means of normal school pupils not included in the above estimate .....	108	108
Total increase of 1897 .....	1,274	478

"For the most part the schools are abundantly supplied with the books and appliances required by modern pedagogy.

"The school fund has a revenue to be applied to educational purposes of more than \$160,000 per year.

*Educational statistics of the Department of Panama for 1897-98.*

Province.	Number of city schools (boys).	Number of city schools (girls).	Mixed schools.	Male teachers (graduates).	Male teachers (nongraduates).	Female teachers (graduates).	Female teachers (nongraduates).	Number of pupils registered (boys).	Number of pupils in attendance (boys).	Number of pupils registered (girls).	Number of pupils in attendance (girls).
Panama .....	15	14	10	5	18	.....	31	1,179	885	1,199	925
Colon .....	3	3	6	.....	3	.....	10	225	153	282	193
Coclé .....	6	6	4	4	3	.....	11	438	321	401	270
Los Santos .....	6	5	6	1	5	.....	11	389	268	339	265
Veraguas .....	3	3	6	1	2	.....	10	203	151	232	199
Chiriquí .....	7	8	4	.....	7	1	7	353	226	242	180
Total .....	40	34	36	11	38	1	80	2,787	2,004	2,745	2,002

Total number of pupils registered of both sexes..... <sup>a</sup>6,592

Total number of pupils in attendance..... 4,006

—(*Directory of Panama, 1898.*)

<sup>a</sup>Leaving, apparently, 1,060 unaccounted for in above table.—*Compiler.*



## VI. APPENDIX.

EXTRACTS FROM REPORTS OF EXPLORATIONS AND SURVEYS TO ASCERTAIN THE PRACTICABILITY OF A SHIP CANAL BETWEEN THE ATLANTIC AND PACIFIC OCEANS BY WAY OF THE ISTHMUS OF DARIEN, BY COMMANDER T. O. SELFIDGE, U. S. NAVY, 1870-1873.

### THE OROLOGY OF THE ISTHMUS OF DARIEN.

(Survey of 1870.)

The terms Darien and Panama are indiscriminately applied to the narrow neck of land between latitudes  $8^{\circ}$  and  $10^{\circ}$  north, connecting North and South America. Properly speaking, the Isthmus of Panama comprises all the territory watered by the Chagres and its tributaries across the divide to the Pacific.

The Isthmus of Darien extends from the San Blas Mountains, which separate the headwaters of the Mandinga and Marmoni from those of the Chagres, to the boundaries of the State of Choco, or to the mountain range from which the Tuyra or Darien River takes its rise, this range running in a southwesterly direction from the mouth of the Atrato toward the Pacific.

The Cordilleras, entering the State of Panama, diverge toward the Pacific, and on the line of the Panama Railroad are not distant more than 5 miles from that ocean. They lose their character as mountains, and the divide, ranging from 262 to 600 feet, is broken into a great number of isolated peaks and hills, through the gorges of which the line of railroad runs to the city of Panama. From the point where the railroad crosses the divide, the latter stretches to the north-east, increasing greatly in altitude, and bifurcates; one fork inclosing the headwaters of the Chagres, and, dividing it from the Mandina, meets the Atlantic in the vicinity of Cape Manzanillo. The other, stretching to the east within a few miles of the coast, takes the name of the Cordilleras Lloranes,

and forms the great backbone of the Darien Isthmus as far as the mouth of the Atrato. It here again suffers a depression, separating the Atrato from the Tuyra, and, turning to the southwest, forms with the Antioquian chain the Andes of South America.

Let the orology of Darien be carefully considered, and it will appear that though through its whole length it is narrower than any other of the transits spoken of, there are but few points which present any probability of a successful search for a low level.

The Cordilleras Lloranes skirt the Atlantic coast at distances varying from 5 to 8 miles, and varying in altitude from 1,000 to 3,000 feet. Between this range and the shore there are three other ridges or hills, decreasing in altitude successively, and cut up with valleys, through which the various water courses wind their way to the Atlantic. This feature does not permit plains of any size, circumscribes the valleys, and, breaking up the whole surface of the country, covered as it is with a dense primeval growth, renders all attempts at a regular survey of a most difficult nature.

From the close proximity of the Cordilleras to the Atlantic, we find no rivers of any size except the Mandinga; they are mostly brooks in the dry season and mountain torrents in the wet.

This dividing range through the length of Darien is very narrow at its crest, in some places not exceeding a few feet in width, with steep slopes and spurs jutting out from each side, over which leads the Indian trail. These spurs inclose ravines, which extend so far into the divide that the water courses which spring from them are often not more than a thousand feet apart on each side, and they would in themselves form an important feature in reducing the estimates of excavation, but for the fact that their mean level is too high to enable us to dispense with tunneling.

The western slope of the Cordilleras, being much wider, is drained by three large rivers. The Bayamo, rising in the Chiman range, an offshoot of the Cordilleras, flows north; the Chucunaqua, also rising in the southern slope of the Chiman Mountains, empties into the Tuyra not far from its mouth; the Tuyra, the largest river of the Isthmus, rising in the boundaries of the State of Choco in the south, drains the western slope and empties into the Gulf of San Miguel.

The Cordilleras skirting so closely the Atlantic coast, it follows that any deep depression in their outline could be seen from the sea, though its depth might be hid by the intervening hills that lie between them and the coast. No such depression is visible except in the valley of the Mandinga, and constant inquiries among different tribes of Indians still further strengthen this fact.

The Chiman range cuts the Isthmus transversely and separates the sources of two rivers, one flowing north and the other south; it is therefore evident the mean height of any transit line will be greater the nearer you approach the center of the Isthmus. In other words, from the configuration of the land as marked by the water courses, it must be at the extremities, and not in the center, that we can with any success hope to find a favorable route.

The northern extremity is but 36 miles across, and is the narrowest portion of the western continent. The southern extremity embraces the valley of the Tuyra; and, though wider than the other portion, it has the advantage, if reports are true, of having the lowest divide anywhere to be found. The question of harbors, entering so minutely into the canal problem, still further narrows our researches.

There are but two fine harbors on the Atlantic coast, the Gulf of San Blas and Caledonia Bay. Both of these are admirable and possess every requirement, and from their vicinity only could a canal well be constructed.

Though the Isthmus of Darien is an unexplored wilderness and but little known, yet, for the purpose of canalization, there are therefore but three portions that admit of any necessity of exploration to settle the question of its adaptability to the purpose in view.

#### CLIMATE.

The climate of Darien, like other portions of the Tropics, may be divided into two seasons—wet and dry. The former extends from May to January; but the rainfall varies greatly for different months. Commencing in May, this month and June are rainy, but in July and until the middle of August the weather is comparatively good, and labor at this period would be but little incommoded.

In the middle of August commence the heavy rains, and they continue until January. Severe squalls, waterspouts,

vivid thunder and lightning, and such rain as may well be called a deluge mark this period. At this time no excavations would be possible not protected with sheds. The rivers overflow their banks and all low land near the coast is inundated.

The dry season, or the season of the breezes as it is sometimes called, commences in January and ends in May. At this time the trade winds blow fresh from the north, and a heavy sea breaks all along the coast, rendering it impossible to land or anchor when not protected by reefs or harbors. The climate at this period is delightful; little or no rain falls except in the mountains, which, intercepting the trade clouds, always precipitate more or less moisture upon the Atlantic slope; the air is moist and cool, the sky clear day and night, and the thermometer ranges between  $79^{\circ}$  and  $86^{\circ}$ .

After the expiration of the trades in the latter part of April, sea and land breezes prevail, and with them the thermometer rises to  $88^{\circ}$  and falls to  $76^{\circ}$ , showers are frequent, and heavy rain for a day or two.

Though the above is the general aspect of the seasons, the experience of this expedition has, however, been different. Rain has occurred more or less every month, particularly three or four days before the new moon, and especially in the interior, where work was interrupted whole days. Though it is a disputed point that the moon has any effect in disturbing the equilibrium of the earth's atmosphere, the changes of the weather with the changes of the moon were very marked upon the Isthmus. The closing days of the lunar month were sure to be marked with rain, and showers were always more frequent in the latter than in the early quarters of the moon.

With us the month of May was marked with unusually severe rains; the enormous amount of 7 inches fall in one night was recorded at Aspinwall; but during the first two weeks in June the weather was charming. Such an amount of rain in the dry season and such a heavy fall in May had rarely been known. The Isthmus of Darien has a most unenviable reputation for sickness. This is partly traditional, from the early experiences of the Spaniards, and partly from our experiences on the Isthmus of Panama, Nicaragua, and other portions of Central America. The formation of Aspinwall and of a portion along the line of the railroad is coral-

line. The *mindí* and other swamps in the bottom lands of the Chagres River hold in decomposition a vast amount of vegetable matter. Unfavorable as this should be, the record of the Panama Railroad develops a mortality of only 293 white men out of 6,000 that were constantly engaged on the work. The coolies fared the worse; the negroes and natives better.

That the Isthmus of Darien is vastly more healthy is not only the unanimous record of every previous explorer, but is abundantly verified by the experience of this expedition, which, numbering a force of 280 men, suffered but one death, and that from drowning, though exposed to a severe test from the constant exposure incident to the survey, which at all times required a large number in the field. The fever we met with differs from the Chagres fever, leaving none of the effects of the latter upon the system, and arose more from fatigue and privation than from any climatic causes. That a less favorable condition of health would be experienced in the wet season is undoubtedly correct; but our ships of war lie for months in the harbor of Aspinwall without injury, and I have no idea, with proper shelter and food, that the excavation of a canal upon the Isthmus of Darien would prove any more unhealthy than in many places in the United States where the virgin soil is first turned up.

#### INHABITANTS.

The whole of the Isthmus of Darien, except a small portion of the valley of the Tuyra, comprising the towns of Chipogana, Pinogana, Yavisa, and Santa Maria, and a few scattering inhabitants on the Bayamo near its mouth, is uninhabited except by the San Blas or Darien Indians. It is on account of their jealous exclusion of foreigners that so little is known of the country. In 1719 the Catholic missionaries had succeeded in establishing a number of towns on the Atlantic coast and upon the rivers flowing into the Gulf of San Miguel, but they were all destroyed by the Indians. In 1790 a treaty of peace was made with the Indians of Darien, in compliance with which the Spaniards abandoned all their forts in that district, in which no white man has since settled. They have the usual characteristics of the copper-colored race, but are much lower in stature than the North American

Indians, being rarely met with over 5 feet 6 inches in height. They are a muscular race, capable of great exertion for which their life in canoes or the broken nature of their mountain homes peculiarly fit them. They are very peaceable in their natures, and I could learn of no conflict between the villages, but yet independent and resolute against foreigners. They inhabit the whole Atlantic coast from San Blas to the the Tarena, mouth of the Atrato, and in the interior from the Sucubti to the upper parts of the Bayamo. There is no head or chief of the whole tribe, as commonly reported; but though the language and customs are similar, each village or tribe has its head man or chief, generally the oldest man of the tribe, to whom all pay great deference.

The Mountain Indians, or Bravos as styled by the Spaniards, are more numerous than generally supposed. On the Sucubti branch of the Chucunaqua we found three large villages that could not have contained less than 1,000 inhabitants. The most warlike, as well as the least known, and probably the most numerous, are the Chucunas and Navigandis, in the center of the Isthmus. The interior, back of San Blas, is uninhabited; neither are the Indian settlements with until you ascend the Bayamo some 40 miles.

The coast Indians, from contact with foreigners, are very docile and tractable, and by a conciliatory course I found no difficulty, after becoming known, in obtaining guides and all the information they possess of the interior; but they stand in awe of the mountain Indians and would never accompany me into their territory. They live principally upon fish, plantains, and bananas, with Indian corn and a kind of cassava. Some sugar cane is raised, the juice of which, extracted in a rude way between two poles, upon one of which an Indian jumps, they mix with cocoa for a beverage.

The women are very short, and their large features and straight coarse hair do not give them a prepossessing appearance. After reaching womanhood they cut their hair short and blacken the teeth. They wear large gold rings in their noses and ears, and necklaces of silver pieces, tiger, monkey, and alligator teeth. The women all tattoo across the bridge of the nose and paint their cheek bones red, but paint or tattoo is seldom used among the men.

I was not able to discover their ancient form of worship. Their belief in a Supreme Being is the result of contact

with the Spaniards a century ago rather than an ancient tribal belief. They believe in evil spirits, and their Leles, or medicine men, have numerous ugly images and ridiculous relics that are believed to possess the power to cure diseases. They are exceedingly averse to labor, except the little required in the cultivation of their fields, and no assistance from this source would be obtained for the work of a canal. They believe that God made the country just as it is, and that He would be angry with them and kill them if they assisted in any work constructed by white men. Work in the fields is left to the women, but the severe labor is mostly performed by men. Polygamy, though permitted, is rare, and the Darien Indians are particularly marked by their jealous exclusion of women from observation. During our stay at Caledonia Bay no women were ever met with, and upon our approach they were always removed from the villages, and this was the only mark of fear they evinced toward us. No traces of amalgamation were met with but some albinos. Their arms are principally the bow and arrow, in the use of which they are very skillful, and the single-barreled shotgun.

The Mountain Indians rarely visit the coast, except to trade their native products, ivory nuts, cocoa, and caoutchouc, for cotton cloths, beads, and a few simple domestic utensils. The Coast Indians carry on a large trade in coconuts, ivory nuts, and tortoise shell. Though the Republic of Colombia has a nominal authority, they have always maintained their independence. They number probably not less than seven thousand, but their strength lies in the rugged nature of their country. Their independence of character prevents the use of presents to any extent, and they will be of little service in procuring a desired policy. Individuals would refuse to receive gifts until they had obtained the permission of their headmen, and I could never prevail upon any of the chiefs to accept anything in my official capacity. An amusing example of this occurred on one occasion. I was paying my first visit to the chief of the Sassardis, and, ignorant of their prejudices, had brought for him a large present of cloth, needles, etc. He at first refused, but afterwards accepted them out of compliment to me, as he said, as I told him it was the custom in my country never to take back a present once given. After our council had broken

up, I noticed a palaver among them, and on my return to my gig found the present returned. I went back and told them I was very angry at their discourtesy, but they replied their customs would not permit them to receive presents from foreign governments. However, I put the present on the beach, and afterwards saw the cloth in the chief's house. This denial of what they would gladly purchase, showed an independence of character cropping out in an amusing way that was pleasant to find.

As a whole this tribe is cowardly, but treacherous, and, though they are to be feared only by small parties, become dangerous in a work like ours, from their knowledge of the country, to the scattered parties engaged in surveying or bringing up supplies.

#### GEOLOGICAL FORMATION.

The geological formation of the Isthmus presents but little diversity from the other portions of the great range of mountains of which it forms a part. There were no indications of recent volcanic action, and but few volcanic stones were found. The mountains themselves thrown up in the original upheaval are immense masses of syenite or trap.

The plains for from two to five miles from the coast are of coralline formation, covered with the alluvium washed from the mountains, a system of reclaiming from the sea which is a striking feature of the world's economy.

Passing from the coralline formation, we meet an outer cropping of sandstone at a high angle, which, although modified by the surrounding topography, taken in connection with the steep slope of the mountains on the Atlantic slope, appears to have been upheaved and at the same time folded over.

At an elevation of 100 feet on the Caledonia route, syenite is first met with, which, forming the substructure of the mountain area, extends for some 14 miles, where the sandstone again becomes visible, which continues the underlying formation until lost in the clay beds of the Chucunaqua. Indications of copper were found in great abundance on the Sassardi and Morti line, and veins of pure copper, though small, were traced for several feet. Iron and copper pyrites were met in great abundance, but no indications of gold

were discovered on any of the routes explored by the expedition.

Large numbers of agates were obtained on the Sassardi line.

The San Blas route was singularly uninteresting in geological specimens. Decomposed syenite and sandstone were met with on the lower portion above an altitude of 20 feet, while trap composed the formation of the great mountain area of this route.

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### DESCRIPTION OF THE PORTION OF DARIEN TO BE EXPLORED.

(Survey of 1871.)

The Isthmus of Darien may be subdivided into three divisions—the northwestern, including the water-shed of the Bayamo River, on the Pacific, and the Atlantic coast bordering on the Bay of San Blas as far as the peak of Playon Chico; the central, from Playon Chico to a line drawn from Cape Tiburon to Cape Garachiné (the Cordilleras break off into two ranges at Playon Chico, one continuing along the coast, the other, crossing the isthmus transversely, ends in the high hills that skirt the north shore of the Gulf of San Miguel. This range forms the divide between the Bayam flowing to the north and the Chucunaqua to the south); the southern included between parallel  $7^{\circ} 30'$  and  $8^{\circ} 40'$  north latitude. From Cape Tiburon the coast range known as the Cordilleras Llorenes pursues an unbroken line, but a short distance from the coast, to the Puerto Escondido. At the latter point it recedes and bifurcates, the one fork running nearly south, gradually lessening in altitude till it disappears at the mouth of the Cacarica River; the other takes a more westerly direction till it strikes the Pacific coast, forming the true divide, known by the name of Sancti Espiritu Mountains. It is in the valley at the forks of this range that the Cacarica, a tributary of the Atrato, rises, emptying into the latter some 40 miles from its mouth.

The western slope of this range is drained by the Tuyra River, which empties into the Gulf of San Miguel. Two tributaries of the latter river—the Paya and Cué—have their sources very near those of the Cacarica and Peranchita.

The divide between them seems to lose its mountainous character, and is broken up into hills and spurs, over which an Indian trail, leading from one side of the divide to the other, is known to the "caoutchandos," or India-rubber hunters, as the pass of the Cacarica. This is the region, therefore, that I proposed thoroughly to explore—a task requiring a combined expedition from both oceans, which, running separate lines of level, should finally connect in the interior.

The principal explorers who purport to have visited this region are Hellert, Lacharme, Gorgoza, and De Puydt. The facts as stated by them are so positive as to the adaptability of this route that one could but feel it conclusive that here would be found a line fully equal to all the requirements of a suitable location.

Hellert contributed a paper upon his explorations to the Berlin Geographical Society, which seemingly gave it such authority that upon its assertions I based my plans for the survey of the Pacific slope. For a translation of this report by Professor Davidson I am indebted to the courtesy of the Coast Survey. Professor Davidson deduced from Hellert's notes the total height of the divide to be but 254 feet, and the Falls of Tapanaca, many miles above the Cué River, but 43 feet above sea-level. This was all *couleur de rose*, and here undoubtedly, if these figures had been borne out in facts, was the long-sought-for spot, or, as Hellert terms it, the "key to the Pacific." He says further that there are 8 to 10 feet, in the dry season, in the Tuyra River, as far as the Tapanaca, and that no rocks were to be seen over the whole of this distance, and the river bottom sandy, with small pebbles.

One may judge of my surprise when I learned from Mr. Nelson, the agent of the railroad at Panama, that Hellert was in his employ while in the country, and never penetrated the interior farther than Pinogana.

Mons. Lacharme, a civil engineer of South America, explored the valley of the Tuyra as far as the divide, in 1865, at the request of Señor Gorgoza, who supposed he had discovered in the Spanish archives information that would lead to the discovery of a pass for the proposed canal. Lacharme published a very interesting narrative of his travels, in Putnam's Magazine. He places the mouth of the Paya River at

144 feet above, and Paya Village, some twenty-five miles up that stream, at only 173 feet above sea-level. He states he followed the Indian trail from Paya across the divide, to a branch of the Cacarica, called the Tuculegua, which he places at an altitude of 169 feet. He purports to have gone some distance down the Cacarica, in all, two days' journey from Paya village, and to have returned in one day, measuring the distance with a chain. He places the summit level of his survey near the village of Paya at 178 feet, which is very remarkable for being the very datum given to him before he set out as the greatest elevation that would be practicable for the enterprise. It is also singular that he should find this summit but a short distance from Paya, when he must have known that the head waters of that river were many miles distant.

Señor Gorgosa also visited, I believe, the village of Paya, and the accounts he published were sufficiently flattering to lead to the formation of a company of capitalists in Paris for the purpose of acting upon his reports. They sent General Heine, an attaché of the American legation at Paris, to examine this route. Heine proceeded as far as the mouths of the Atrato, but, not being properly prepared, did not ascend the river, and returned to Aspinwall. The true facts obtained by the expedition will show how erroneous were the estimates of these explorers, and how much we who had believed in them were deceived.

### INHABITANTS.

The population of the region explored during the past year may be divided into Colombianos and Indians. The former are composed of whites, mulattoes, samboes, and negroes. The latter compose at least five-sixths of the whole, and are an athletic race, but lazy and shiftless. They are to be found in the villages of Chipigana, Santa Maria del Real, Molineca, Pinogana, and Yavisa in Darien, and the small village of Turbo, or Pisisi, on the Gulf of Darien. They are principally engaged in the production of caoutchouc, in which an industrious man can easily earn \$100 a month; and as it permits a free and lazy existence, it is difficult to procure laboring men except at the most exorbitant rates.

At one time, no doubt, the whole of the valleys of the

Tuyra and Chucunaqua were inhabited by the Darien Indians, but they have disappeared entirely from the former, excepting the Paya tribe, on the river of that name. These Indians are less averse to strangers than any I had met with previously, owing, no doubt, to their long intercourse with the Spaniards, of whom, however, they are perfectly independent, and with whom there are no signs of amalgamation. They treated me with kindness when I visited them, but were sharp enough to avail themselves of our necessities in driving hard bargains for provisions. They do not number more than four hundred.

On the Atlantic slope, near the Tarena mouth of the Atrato, we have the villages of Arpeti, Cuti, and Tanela, all under the chief of the latter. The Indians of these villages are as isolated as those of the interior, and have all of the latter's dislike to white men. They have no dealings with Europeans; their towns are only approached through small streams in the marshes of the Atrato, where one is almost devoured by mosquitoes, and their only glimpse of the outer world is when they visit Pisisi to trade for the few wants they may require. These Indians were described by those of the expedition who visited them as the finest that had been met with in Darien. De Puydt asserts to have descended to the Tanela village, and even beyond; but, on the other hand, their chief, Suza-le-Lele, who was very unwilling that Lieutenant-Commander Schulze should explore their domain, told him that he was the first white man who had ever penetrated so far.

On the Chucunaqua there are now no villages of Indians below the Sucubti River, which was visited by the expedition in 1870.

The Indians of the Atrato Valley, called Chocó, are of a much milder disposition than the Darien. They were entirely subjugated by the Spaniards, and under these hard taskmasters were almost depopulated, and lost their tribal organization. Here and there families are to be found upon the rivers. They are quite inoffensive, and ready to offer their services as boatmen or guides. They are not averse to labor, and at Cupica Bay I found them tilling the ground by the side of the Spanish negro, whom in their present degraded condition they consider a superior being.

**CLIMATE.**

The climate of the lower portion of Darien is materially the same as that of the region explored last year. Of the two seasons, dry and wet, the former commences about the 1st of January and extends to the 20th of April. At this period the wind blows invariably from the north. After April there is more or less rain till the 21st of June. My own experience would lead me to believe that the heaviest rains during this season are in the first three weeks of May, and after that pleasant weather is frequent. July, though not a dry month, has but little rain. August denotes a reappearance of the wet season, though there is often much pleasant weather. September and October present the greatest rainfall; in November the amount is less, though this is the month of the most violent storms, accompanied with heavy rains. The rainfall in the interior is much greater than on the coast. While we were having only showers about the 1st of May, the journal of the surveyors records heavy rain. As to the effect of the seasons upon the construction of a canal, during nine months of the year there would be no more than partial interruption, and of these five may be considered as dry months. During the remaining three—September, October, and November—it is not probable that any work could be done except under cover. The wind during the wet season is usually from the south and west, with frequent calms. The temperature during the dry season is necessarily much higher on the Pacific slope, and the nights are often hot and close.

**SOIL.**

All through the Isthmus and valley of the Atrato the soil is of unsurpassed fertility. On the lower ground, subject to overflow, it has been enriched by the deposit of rivers annually brought down for ages, while at higher elevations the vegetable decomposition going on in the dense forest growth has given it a rich, loamy composition. All tropical products would flourish in profusion, but the ground is peculiarly adapted to the production of the sugar cane, which grows to an enormous size. Plantains are the staple food for both Indians and negroes.

The indolence and indifference of the inhabitants, the sparse population, and the enervating effect of the climate upon Europeans, seem to present almost impassable barriers to its improvement; and unless acted upon by such a powerful impetus as would be produced by the construction of a ship canal, it will probably remain forever in all its natural wildness.

#### FORESTS.

The whole of Darien is covered with a vast primeval growth from its swamps to the top of its highest peaks. Many of the trees I am unacquainted with, but among them are the following, more or less known: Caoutchouc, mahogany, ebony, oak, cedar, rosewood, espavé, quito, lignum-vitæ, ironwood, besides numerous varieties of the palm family.

The forest trees support whole families of parasites, and from almost every branch hang festoons of vines, which hide the trees from which they spring and present a scene of the richest luxuriance.

The puma, jaguar, tapir, and tiger cat inhabit the forests of Darien, but, hidden by day in the dense solitudes, are rarely met with. Many varieties of the snake family abound, whose bite is generally deadly. The wild hog, or peccary, is found in great numbers all over the Isthmus, and forms the chief article of meat for the natives. Monkeys are numerous; also a small species of deer, armadillos, rabbits, and squirrels. Parrots and parroquets of the most brilliant plumage are met with everywhere; also the toucan, carpintero, chucara, and many other varieties not familiar. Wild turkeys are plentiful in the valley of the Atrato, and on the hills a beautiful bird like a pheasant, called by the natives the currasaw, is sometimes seen.

#### RIVERS.

The two principal rivers of the portion of Darien explored the past year are the Atrato and Tuyra. The Atrato, probably the fourth largest river in volume in South America, rises in a spur of the Antioquian Range that connects the latter with the divide, or Cordilleras of Darien. Flowing on a course generally north for several hundred miles, it discharges itself through thirteen mouths, of which the principal

are the Tarena, Candelaria, Barbocoas, Coquito, Coco-Grande, Uraba, and Pichindi, and empties into the Gulf of Darien. The valley which it drains, between the Antioquian Mountains and Cordilleras, extends from latitude  $5^{\circ} 26'$  north to  $8^{\circ} 5'$  north, and varies from 100 to 150 miles in width. Its principal tributaries on the west bank are the Cacarica, Salagui, Truando, Opogado, Napipi, and Bojaya; on the east, the Tumarador, Sucio, Murindo, and Muri. The Atrato was surveyed by Commander Lull for 160 miles, or as far up as the mouth of the Bojaya. Its banks are low, and for the whole of this distance during the wet season are overflowed to the depth of 3 or 4 feet, from which cause all the houses are built upon piles. Below Sucio there are no habitations upon the banks, as they are submerged ten months of the year. This river resembles the lower Mississippi in grandeur of proportions, with its long reaches, its width, varying from 1,500 to 2,500 feet, and its great depth, often exceeding 60 feet. Its current varies from 2 to 3 knots per hour, which would be much increased in the rainy season but for the overflow of the banks, which permits an escape of the surplus water by spreading for miles over the adjacent country. Trautwine, in his report upon this river, states that there are not more than 18 feet 90 miles from the mouth. It is probable that his soundings were made from a canoe, which, in passing upstream, would keep in slack and shallow water.

Our survey was carefully made in a rowboat floating down with the current, and nowhere in the channel were found less than 28 feet. Over the whole distance surveyed no rocks were met with, the bottom muddy, and from its great depth the river was unobstructed with snags. So well defined is its channel, and so free from obstructions, that a single passage up and return would be sufficient to make one acquainted with the navigation. The mouths of the Atrato are at present obstructed by bars, upon which there will never be found more than 6 feet of water. They differ in character, however, according to their protection from the sea. The Uraba mouth, the one that it is proposed to utilize, being farthest from the sea, and also protected by a long sand spit, is fixed in its nature, and the bar of hard sand. These bars, as they are increased by fresh deposits, are slowly extending out, and break off abruptly from 2 fathoms into 10. An examina-

tion of the Uraba mouth showed that as soon as the deposit on each side of the channel was sufficient to rise above the water and give growth to water plants, the water commenced to deepen; and where the banks were of sufficient consistency to give growth to mangrove and palm, and thus confine the flow of the current, a depth of 4 or 5 fathoms would be found. In the improvement of the bar, I would suggest that this action of nature be imitated in creating artificial banks by piling out to deep water, and a channel dredged out, which could be accomplished at a moderate outlay.

**THE TUYRA.**—This river differs entirely in its character from the Atrato. It rises in the Pirri Range, not far from the Pacific coast, flows first east, then gradually in a semi-circle to the north as far as the Paya, and, taking about a west-northwesterly course, empties into the Gulf of San Miguel. Above tide water, during the dry season, its bed for 50 miles is filled with rapids, upon which there is scarce water enough to float a canoe to the Falls of Tapanaca. Above the falls it dwindles into a small stream. It is about 300 feet wide over most of this distance, very crooked, and the marks on the trees indicate a rise of 16 feet during the wet season. Passing almost its entire course through a hilly country, through its numerous tributaries it pours out a vast flood of water during the season of rains. Of its branches, the principal, on the left bank, are the Tucuti, Pirri, Arusa, Cupe, Paca, Piedra, and Cana. On the right bank it receives the Chucunaqua from the north, a river of the same size and hardly a tributary; the Yape, Pucro, Paya, and Cué, the latter probably the same as known as the Punusa in the old Spanish maps.

#### EVAPORATION.

Experiments at Muertos Island, Gulf of Darien, continued through the greater part of the dry season, showed an evaporation of 1 inch in five days. As this test was made with a very small body of water (in a wooden tank made for the purpose) it is believed to be the maximum amount for this locality, and though a smaller quantity than generally allowed for this latitude, yet when the very moist condition of the atmosphere is considered it is not surprising that it is not capable of absorbing more.

**HEALTH.**

The sanitary condition of the late expedition has been fully equal to that of 1870, and the fact that no mortality has taken place from climatic causes is most gratifying, in the face of the reports of the unhealthiness of this part of the continent.

The percentage of sick on both expeditions has not been much greater than upon the ordinary service, though officers and men have been constantly exposed to the full malarial effect of the climate. The prevalent diseases were fevers (remittent and intermittent), disorders of the digestive organs, and skin diseases. Fevers did not assume a dangerous type, though very exhaustive in their effect. Eczema occasioned much annoyance, and was difficult to heal. Bites from the hordes of insects that infest the jungles and forests, though not dangerous, were very painful, and, in causing loss of sleep, often brought on fever.

Malaria, though necessarily active in such a wet climate as that of the Isthmus, does not, in the uncleared portions, appear as poisonous as in many other portions of the world which have a higher reputation for health. I attribute the fact to the hilly nature of the country and great waterfall, by which all vegetable decomposition is quickly carried off, and also that the dense tropical growth does not permit the action of the sun's rays.

To the very stringent sanitary regulations, such as requiring flannel to be worn next to the skin, or, when on the survey on shore, that every person should put on a dry flannel change at right; the liberal use of quinine as a prophylactic, in doses of  $1\frac{1}{2}$  grains every morning to each person in the field; to the ample supply of wholesome food, at least 3 pounds to a man; to the absence of intoxicating drinks; and to the but moderate indulgence in fruits, may be attributed, under Providence, in a great degree, the health of the expedition, engaged as we were in a fatiguing and laborious task, exposed alternately to the fierce rays of a tropical sun and to constant wettings from rain or work in rivers.

The experience of this expedition and others, of the Panama Railroad Company, and of residents on the Isthmus, proves that the climate is not as unhealthy as generally sup-

posed, and that it is possible to reside here many years without serious injury.

In the employment of such a vast body of men as would be required in the construction of a ship canal, the preservation of health is a subject of the highest interest, not only on the score of humanity, but as vitally important to the success of the enterprise. It is confidently believed that by comfortably constructed quarters, with which should be connected apparatus for the quick drying of clothes, by rigid sanitary regulations, and by a regular supply of wholesome food, a state of health may be maintained that will compare favorably with newly opened districts in the United States.

Though the Indians, so far from increasing in numbers, appear to be rather the reverse, yet the great mortality seems to be in childhood, for many of the men attain a great age.

### GEOLOGICAL FEATURES.

The study of the geology of those parts explored by the expedition, in their relation to other portions of the Isthmus, is very instructive; and attention is called to the interesting report of the geologist, Dr. G. A. Maache, upon this subject.

The results of our explorations of last year indicated that the base of the mountains forming the backbone of the Isthmus is principally syenite, which places them in the primary formation; while our observations, on the present expedition, from the valley of the Atrato and on the line of the Panama Railroad, would denote a substructure of trap and trachyte, and of a more recent creation.

From this we are led to infer that the central portion of the Isthmus was of an origin coeval with the continents of North and South America; that the foot of these mountains was washed by a united ocean, and not until a later period were the connecting links upheaved; for the geological and physical features of the southern portion of the Isthmus are very different from the central, the regularity of the Cordilleras losing itself in a broken country of very much less altitude, of which the hills are principally of a trappean origin.

The extraordinary depth of the Atrato for 200 miles from its mouth, and the very little fall in this distance (40 feet), though surrounded at not great distances by high hills and mountains, indicate plainly that the whole valley of the

Atrato was at one time an estuary of the ocean; that by a later upheaval the continents were connected and the oceans were separated, when commenced a gradual encroachment upon the sea from the decomposition of the hillsides (which is comparatively very rapid in this climate), being carried down by numerous streams, and, upon contact with another force from ocean waves and tides, deposited upon the bottom. We see this going on now in the changing of the delta of the Atrato, only very much slower, because from the sheltered position the action of the ocean is much less felt, and the influence of the many streams from the east side of the Gulf of Darien tend to carry the sediment of the Atrato farther seaward.

The geology of the Napipi River and Cupica Bay is of special interest, as having been the line selected that presented the most favorable features for the construction of a ship canal. Here the hills rise precipitously from the sea, and then slope away gradually till they terminate in a plain reaching to the Atrato, with a fall of about 5 feet to a mile. The formation of the hills surrounding Cupica Bay and the divide is trappean, and a closer examination of its mineralogical properties would constitute them principally as what is known in petrography as "hornblende andерite." Once over the divide, we have a stretch of some 3 miles of table land interspersed with clay hills of a moderate height. After descending into the plain, the outcroppings of rock become rarer as one proceeds, and often so decomposed as to be cut with a knife; and near the Atrato a stratum of decayed leaves is frequently met with below the surface, overlying red and blue clay. The rock at Cupica Bay, at the falls of the Limon River, and upon the Napipi, indicates great density and hardness; but the question of being self-sustaining can only be satisfactorily ascertained by boring.

No minerals were found during these explorations between the Atrato and the Pacific Ocean, though the formation is favorable to gold, and considerable quantities of the precious metal are obtained in the rivers that rise in the Antioquian range, which is of a similar formation.

Gold ornaments of ancient manufacture have been found in the bed of the Napipi River, and I have been told by the Indians that there is gold in the mountains, though they always refused to give any information in regard to it.

A very important discovery of coal was made in the region bordering upon the east side of the Gulf of Darien, an analysis and report of which, by Professor Barker, of Yale College, is appended to this report.

The survey of the Tuyra developed the general geological features of the Napipi. Interesting specimens of fossilized shells, embedded in rock and detached boulders, were found at various points on the Tuyra, and even on the top of hills—an additional proof that this formation comes within the later Tertiary formation.

Fossilized coral is found in the bed of the Chagres, 30 miles from the sea, and at a considerable altitude, while at the same place will be gathered pebbles of quartz, jasper, agate—all belonging to a different period than fossils.

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#### DISCUSSION OF PROPOSED CANAL ROUTE VIA THE NAPIPI AND DOGUADO VALLEYS.

(Report of 1873.)

Much has already been said of the nature of the country, and difficulties to be encountered, in the valley of the Napipi in my previous report.

But as the value of this route depends so entirely upon the capacity of ship navigation of the river Atrato up to the point we leave it to cross to the Pacific Ocean by an artificial cut, I will again allude to it before proceeding to discuss the general features of the new proposed line.

Our knowledge of the Atrato is based upon a complete line of soundings, run by Commander Lull, for the whole distance, from the mouth of the Napipi to the mouth of the Atrato, who made the survey in his gig, taking soundings every five minutes. So important is the fact of the great depth of the Atrato that I append his letter to me on his return, as also one from the officer who accompanied him, Lieutenant Merrill:

UNITED STATES SHIP GUARD, FOURTH RATE,  
*Gulf of Darien, United States of Colombia, May 1, 1871.*

SIR: I would respectfully inform you that, in obedience to your order, I have examined the river Atrato, from the mouth of the Napipi down to the mouth of the Cacarica, sounding as rapidly as possible, while pulling gently with the current, in the gig of this ship, making a running traverse at the same.

The least water found in the channel of the river was 28 feet although the surface was at least 6 feet below high water; we frequently found over 12 fathoms. There are very few obstructions, in the shape of snags, etc. All that we saw could be cleared away in a single day's work by a steamer.

The channel follows the curves of the shore so exactly that any pilot, after once going up or down the river, could never after make a mistake with regard to it. It is the clearest river I have ever seen.

The river bottom is all soft mud; we did not discover a single rock or stone the whole distance.

I beg to say that I use superlative language advisedly in speaking of this river, as its advantages for navigating purposes struck me as being so remarkable that I examined it with great care.

I am, very respectfully, your obedient servant,

EDWARD P. LULL,  
Commander.

Commander THOS. O. SELFRIDGE,  
*Commanding Darien Exploring Expedition.*

MARSHALL, Mich., August 5, 1873.

SIR: I accompanied Commander Edward P. Lull, U. S. Navy, on the survey of the Atrato River, and am confident that, after crossing the bar at the mouth, there will be no difficulty in carrying 28 feet of water to the mouth of the Napipi.

Very respectfully, your obedient servant,

JOHN P. MERRILL,  
Lieutenant, U. S. Navy.

Commander THOS. O. SELFRIDGE,  
*U. S. Navy, commanding Darien Expedition.*

No one who has visited this river and floated upon its surface as I have can but be struck with the grandeur of this mighty flow of water and can but feel that it has been designed by the Almighty to bear a more important part in the great economy of the world's progress than the carrying of the little crafts which are now its sole navigators.

That the Atrato is entirely and wholly capable of ship navigation to the Napipi is a fact that no longer admits of any doubt.

#### **BAR OR OBSTRUCTION AT THE MOUTH OF THE ATRATO.**

The Atrato spreads itself out into a delta at least 20 miles in length, and empties by 13 mouths into the sea.

The great difficulty that has been met in the permanent improvement of the mouths of all the rivers that empty into the Gulf of Mexico is the shifting character of the sands, caused by the action of the sea swell, and which requires the

constant use of the dredge, as at the mouth of the Mississippi, where the storm of a single night may open a channel entirely different from the one in use. While nearly all the mouths of the Atrato are exposed to this same influence that one known as the Uraba is an exception, as it empties into an almost land-locked harbor, the surface of which is hardly ruffled. This fact gives the character of its bar a permanence which none of the others possess in the same degree. Specimens of boring at a depth of 18 feet below the surface indicate that it is composed entirely of black and white sand whose geological properties are the same as the hills from which the tributaries of the Atrato flow. I was also struck by the fact that as soon as we crossed the bar to a point where the overflow was restrained by the growth of plants, then did the depth commence to increase, and as soon as the flow was confined by banks compact enough to sustain vegetation, the water at once deepened to five fathoms. This action of nature to my mind was conclusive proof that if the current was confined by artificial banks and the inclosed distance dredged to the required depth there would be a permanent channel requiring no further outlay to keep open.

From the ten-fathom line to a depth of five fathoms in the Uraba Branch it is about 2,500 feet. There would be required for a double row of piling the whole of this distance 10,000 trees 30 feet long and 1 foot or more in diameter. Trees of the variety known as the cedron, guallaca, or truntago, chacajo, and insivé can all be cut on or near the Atrato and its tributaries. These varieties are all hard and very durable, of a specific gravity less than water, and could be therefore floated to the desired spot and driven at a cost not exceeding \$5 per pile.

For a channel 300 feet wide and a depth of 26 feet of water, there would require to be removed 640,000 cubic yards of material. The expense, therefore, of the required improvement at the mouth of the Atrato would be:

10,000 piles, \$5 each .....	\$50,000
640,100 cubic yards material, 50 cents per cubic yard .....	320,000
	<hr/>
	370,000
25 per cent increase for contingencies .....	92,500
	<hr/>
Total .....	462,500
*            *            *            *            *            *	*

## POISON OF THE INDIAN ARROWS.

(Survey of 1870.)

We inquired of all the Indians, both men and boys, at Caledonia Bay and at San Blas for the "curari" or "urari" poison, so often mentioned, but none of them appeared to have ever heard the name. They admitted that they used poison on their arrows, and after numerous attempts they brought us what they represented to be the bona fide poison. It was a watery liquid with a white precipitate at the bottom, which became milky by shaking. They, by signs, gave us to understand that when it was intended to be particularly virulent it was necessary to expose it for three days in the sun, then mixed with a paste before applying it to the arrows. It turned out to be nothing but the juice of the manzanillo del playa. So, if this is their chief poison, and is the same as the "curari," it is not so much to be dreaded. Its effect appears to be different on different constitutions; on some, the juice will raise blisters, and the smoke of the burning wood will attack the eyes, while others experience no harm. The natives wash the injured parts in salt water, which is readily obtained, as the tree, fortunately, only flourishes near the sea coast. The young leaves and fruit steeped in milk are also said to be a perfect antidote. That which we have is extremely volatile, giving off a strong smell of sulphureted hydrogen and other smells which we could not detect. From its volatile nature alone we would infer that it was only to be dreaded while fresh, although the Indians maintain that exposure to the sun for three days causes it to regain all its strength. We tried some of it on our hands when first obtained, and it had no effect beyond the stinging produced by acid; we also have made several experiments on rats and cats since our return. The animals appeared to grow sick after ten minutes, inclining to cough or vomit, but in the course of an hour all unpleasant effects appeared to have passed away and they were as well as ever.

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**MEDICAL REPORT OF THE DARIEN EXPEDITION, BY  
LINNÆUS FUSSELL, ACTING PASSED ASSISTANT  
SURGEON.**

(Survey of 1870.)

PHILADELPHIA, *August 25, 1871.*

SIR: In this report the facts recorded will be for the most part such as fell under my own observation. I shall, however, bring to bear on the subject information received from other sources, from the surgeons of the *Resaca* and *Guard*, and of the Panama Railroad Company, from books, periodicals, etc.

My services upon the Darien expedition lasted from December 3, 1870, to June 27, 1871. During that time I had medical charge of a surveying party for one hundred days, from February 22 to June 3, 1871, this service being a continued one in the wildest portion of the Isthmus of Darien.

The following is a summary of the amount of sickness, etc., during that time:

Number of men in party .....	24
Admission to sick list .....	41
Number of sick days .....	123
Average time sick, days .....	3
Daily average .....	1 $\frac{23}{100}$
Daily percentage .....	5

These numbers may appear large; they are really the reverse, for this statement includes every case, medical or surgical, excused from duty from any cause however slight. No deaths occurred; no cases became chronic; no severe form of disease existed at any time during the progress of the survey. These observations apply not only to the party which I accompanied in the woods, but to the whole expedition, and for the whole time.

Several other surveying parties were on other parts of the isthmus, and the greater part of the officers and crews of the *Resaca* and *Guard* had extra work to do on hydrographic and other duty connected with the survey. All were exposed to the direct rays of the burning sun, to the poison of malaria, or both. With the whole command the same sanitary precautions were taken (which will be referred to hereafter), and with about equally good results.

Malarial fevers (intermittent and remittent) formed the greater part of the cases, twenty-one of the admissions out of

forty-one being cases of fever. Most of the other affections met with showed a distinct malarial impression, and all were benefited by the treatment proper to cases of fever.

Many causes cooperated to produce cases of sickness, the first and most important one being the poison of malaria, to which we were constantly exposed. Many different opinions are held as to the nature of this peculiar poison, to none of which I need allude. All agree that for its production, vegetable decomposition, favored by heat and moisture, is necessary; that this decomposition is most active when there is no more moisture than is necessary for that purpose. Uncommonly rainy seasons, followed by unusually dry ones, are very favorable to its development, as is every change by which a perpetual alteration of the water level is occasioned.

These conditions were present during the whole time of our trip, most markedly so at the commencement and toward the end of our survey. At the commencement the rainy season had ended, but the water which covers the lower portions of the country during this period had not yet had time to descend to its lowest point, and while we were ascending the river Cué the water was gradually falling, exposing masses of vegetable matter to decay, and constantly adding to the amount of malaria everywhere present. During the last month our survey took us over a very rough country, which, though generally of the kind which a late author speaks of as "very active in the evolution of malaria," ("such as are traversed by percolating streams or canals in wooded districts, termed jungles,") was composed of a succession of hills and valleys extending from the mouth of the river Paya (emptying into the Tuyra) to the town of Pinogana, a village some 30 miles farther down. The weather was also such as to favor the production of malaria—rain for one or two days, followed by hot, dry weather for a corresponding period. Other causes which had their influence in predisposing to disease may be merely alluded to; the fact of being compelled on many occasions to wear wet clothing, not only during the day, but at night, for, although ordinarily great care was taken to have the men put on dry clothes on finishing their work, it would often be impossible to keep dry owing to very heavy rains and imperfect shelter inseparable from such work in a perfect wilderness. The effects from bites from hordes of various kinds of insects, etc., may be alluded to, not sim-

ply from their local effects which were sometimes severe, but from the loss of sleep occasioned by this persistent annoyance. In this connection the bites of vampire bats should be referred to, as the stories told of them are by many deemed rather apocryphal. We were troubled with them more or less during the whole time we were out, but ordinarily they did not prove a serious annoyance; toward the latter part of our trip, however, some one was bitten almost every night; one night, the 13th of May, nine men were bitten. The men were rarely awakened by the bites, which, however, bled freely, sufficient blood being usually lost to saturate the clothing, and to show its effects very perceptibly in the loss of color and general feeling of weakness experienced.

I have now to consider the reasons which, notwithstanding the various predisposing causes to disease, led to the general continuance in health of the various members of the expedition. I would mention first, the fresh and most excellent water which we always found without difficulty; second, having regular hours for meals, and the good food furnished, it being of better quality and of larger quantity than that furnished to any army or navy in the world, amounting to 53 ounces ( $3\frac{1}{8}$  pounds) of solid food per diem for each man; third, the total absence of all causes of excitement; fourth, the absence of all kinds of intoxicating liquors; the care taken to have each one in the party wear flannel next the skin. The good influences to be expected, *à priori*, from these causes are so evident that it will be needless to dwell upon them. As to the prophylactic use of quinine, some words will be necessary. With us the sulphate of quinia was used regularly from the time of starting out and continued during the whole period, with the exception of some three or four days. Before that time we had had but three cases of fever, all light attacks. At the end of the fourth day of the time in which the use of quinine was omitted, three men were attacked with the fever and on the following day three more. These six cases were in every respect the most serious ones I had to treat during the whole trip, though even they readily yielded in a few days to the free use of quinine. When these men were taken sick we were not exposed to a greater amount of malaria than before. The good effects of the daily use of quinine were so marked as to be readily perceived by even the sailors and macheteros of the party, with

whom at first great difficulty was experienced in getting them to take the medicine. Afterwards, however, they never neglected to come for it when served out in the morning, and used frequently to ask at other times for extra doses. It was given usually immediately before breakfast, about half the time being administered in solution in whisky, four grains to the ounce for each dose. Occasionally, after extra exposure or an unusually hard day's work, a dose would be given in the evening. During a portion of the time it was given suspended in clear, cold coffee, a method which masks most effectually the peculiar bitterness of the remedy; but I prefer, however, for small doses, the solution in whisky, the small amount of the latter in each dose being in itself very beneficial.

Quinine, as a prophylatic against fever, has long been used, and its good effects noted by all who have had experience in its use. I shall introduce here two quotations from writers upon the isthmus: "In 1855 the use of quinine enabled the Panama Line of steamers to continue their service during the sickly season, and has ever since been found to reduce the number of sick in the service to a mere fraction of its former amount, while it preserved from disease in a remarkable manner the officers and dependents of the railroad company on the isthmus." Dr. I. K. Merrill, surgeon of a mining and exploring party on the isthmus, states that "for more than two years the party enjoyed an almost complete immunity from miasmatic disease under the systematic use of quinine.

The proper mode of giving quinine in cases of fever is a question upon which there has been much discussion, the principal difference of opinion being whether it should be given in one or at most two large doses or in small doses frequently repeated. My experience, which is in conformity with that of the surgeons of the Panama Railroad Company and that of a majority of the profession, is that one large dose—15 to 25 grains—should be given as early as possible, either as soon as the paroxysm has subsided or, if a recurrence of the attack is anticipated, in a short time, even at the commencement of the sweating stage, and with most excellent results.

It may be noted as a fact of importance that the antifebrile influence of quinine does not coincide with its physiological

effects, which are manifested almost immediately and subside in from six to eight hours. It is certain that the anti-febrile effects are manifested at a later period.

A word as to the manner of administration of quinine in large doses. Pills are readily taken by many, but they soon become hard and insoluble. The solution with sulphuric acid is undoubtedly the form in which it is most readily introduced into the system, but the taste is to many so unpleasant as to prove a matter of some importance in causing nausea and vomiting, which are easily produced in these fevers. I usually give it suspended in clear cold coffee, a mixture which a noted author says "produces a precipitate of the insoluble tannate of quinia, which is probably decomposed but slowly in the system." In every case, however, I found the physiological effects to be produced in about the same time as when given in the solution with aromatic sulphuric acid, and its curative effects were certainly as well marked as could be desired. When there is hepatic congestion the administration of calomel is usually called for in connection with the use of quinine. Opium is in many cases a useful adjunct. One point more as to treatment, and that is to put in my word against the necessity of any "preparation of the system" for the use of quinine by the use of purgatives, emetics, or both, as recommended by many. It seems to me scarcely ever necessary and often absolutely hurtful, as valuable time is often thereby lost, the natural tendency of the disease itself being sufficiently exhausting without adding to it by such unnecessary drains upon the system.

Whether the system can become even in a measure acclimated to the poison of malaria is a question which seems to me should be decided in the negative, but upon this point "doctors disagree." Professor Aitken says, "It is now an established fact that no one can be acclimated so as to withstand the influence of malaria." Dr. Stephen Rogers says, "Gradual acclimation diminishes the danger of being attacked by the more violent forms of miasmatic disease."

Upon the diseases other than malarial met with little need be said. We were troubled with various forms of skin affections, which I here only allude to to note the good effects of carbolic acid, which was used in solution, one part of the acid to forty of water, and applied in almost every case. Its use

was mostly followed by immediate relief of itching, and a cure was generally accomplished in a few days.

Is the climate of the Isthmus a very unhealthy one or not? This is a question about which there is a wonderful diversity of opinion. There seems to be a very widespread notion that it is not only very unhealthy, but one of the most pestilential places to be found, and thus most writers who have mentioned the climate speak of it. Residents of the Isthmus, on the other hand, including the different medical men there, are unanimous in their assertions that it is not unhealthy. They maintain that they have fewer diseases on the Isthmus, and even proportionally fewer cases of malarial fever, than are to be met with in various portions of the United States, and not only fewer cases, but cases of less dangerous type. It would be uncandid not to mention that yellow fever has at various times been prevalent on the Isthmus, and that when met with it has occurred as an epidemic of severe type; during the last one (which occurred in 1868) from 75 to 80 per cent of those attacked succumbed to the violence of the disease. From as extended an observation of the country itself as I could make, from information derived from the statistics for the last three years of the medical service of the Panama Railroad Company, and from conversations with different medical men there I have reason to believe that the statements of the residents of the Isthmus as to their climate are substantially correct, as far at least as the towns of Panama and Aspinwall are concerned.

It must be remembered, however, that malarial fevers are not usually met with in cities, and that the use of quinine as a prophylactic is there largely resorted to. In the smaller native villages, where this is not the case, fever of a violent type is very common, deaths occurring frequently. The conclusion, therefore, seems to me evident that malaria is everywhere present on the Isthmus, less so in the cities, but that its ill effects can to a great extent be prevented by the use of small daily doses of quinine, with the observance of various hygienic rules, the use of flannel next the skin, the avoidance of the use of intoxicating drinks, and of exposure to the open air during the morning and evening, being careful to avoid exposure after extreme fatigue from any cause. With this care I am satisfied a long time may be spent on the Isthmus

with but little detriment to health; without such precaution, however, the effects of the climate are speedily shown, being first manifested upon the nervous system, langor, lethargy, loss of appetite being almost immediate results, fever and disease of the digestive organs following surely in due course of time. To conclude, it seems to me that *the* most practical point of this inquiry is, whether in case of a ship canal being built across the Isthmus passengers would be exposed *in transitu* to malarial diseases? In view of the facts already noted, this seems to admit, without further argument, of a ready answer in the negative.

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**ISTHMIAN CANAL COMMISSION—THE REPORT OF THE DARIEN SURVEY, EASTERN DIVISION, 1899-1900—BOYD EHLE, PRINCIPAL ASSISTANT ENGINEER.**

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**ENGINEER EHLE'S REPORT.**

*The Caledonia depression.*—Rio Caledonia empties into the bay in front of its main entrance from the sea, where there is least protection from the surf caused by the northerly trade winds. From the shore, and perhaps half a mile inland, the formation is coralline, slightly covered by the débris of the river. At a point about half a mile inland the valley becomes very decided, with a general width of about 1,000 feet, this width continuing to the "forks," at about  $4\frac{1}{2}$  miles from the river's mouth. The river here divides into two branches of nearly equal volume. The one coming from the southeast rises in high hills, and its valley—a veritable canyon—is broken by many cascades filled with huge bowlders. The trend of the valley is somewhat parallel to the divide, and offers no evident chance for an economical canal location. This river is probably the one that caused Gisborne's error. The other branch of the main river lies in a southwesterly direction—nearly at right angles to the divide—with a wide valley nearly similar to the main river for about a mile above the "forks," where it reaches the foot of the divide. There is a short, steep ascent in less than 1,000 feet from the creek bed to the divide's lowest point—683 feet elevation—and then comes the gentle incline of the Pacific drainage.

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*The Aglaseniqua Gaps.*—The Rio Aglaseniqua empties into Caledonia Bay about a mile northwest of the Rio Caledonia, and is of smaller size. The general trend of the valley is east and west. Its watershed was fully developed by the surveys of party No. 1, showing that the depression made by its headwaters in the divide are at greater altitude than at the Rio Caledonia; also that the depressions have greater altitudes as they are farther away from that gap. The first two saddles are about 750 feet elevation, the next about 815 feet, then one over 1,000 feet, etc.

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*The Carreto Gap.*—As this depression appears very low from the sea, a detailed examination of this vicinity was made, but this developed no advantages over the Caledonia Gap. Carreto Bay is well protected and has sufficient depth. The valley of the Rio Carreto is quite wide for several miles and then narrows to a rocky gorge that offers small chances for a canal location. The ascent from the river to the divide, with its least elevation 815 feet, is very steep; but then there is a flat slope to the Rio Chucunaqua. There is greater width of the Isthmus than at Caledonia Gap.

*The Sassardi Gap.*—A view of this depression from the sea suggests better possibilities than are realized after a detailed investigation. The Rio Sassardi enters Caledonia Bay in its northerly part, opposite a channel out to sea. There is a coastal plain over 2 miles from the beach which can be crossed in any direction with a canal line with but light work. Then the valley of the Rio Sassardi is badly broken by two interlocking spurs, which can not be passed by the easy curves necessary for a canal. The valley beyond this point is favorable for about a mile, and then its tortuous course renders it unfavorable for canal purposes. From the river the Atlantic side of the continental divide is very steep. The least elevation in the depression is 1,098 feet, and from this point there is a steep descent to the Rio Morti. There is a clear view down this valley; and the Chucunaqua-Sabana divide appears as a flat, and beyond this was a low divide, probably in front of the Pacific Ocean. On a projected canal line through the Rio Sassardi and Rio Morti valleys, and crossing the low divide to the Rio Sabana, there would be a very short distance between tide water—probably the shortest distance on the continent.

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*San Blas depression.*—A detailed examination of the region of possible feasibility for a canal was made extending along the divide between the high hills. The point of least elevation, 956 feet, is at the headwaters of the most easterly branch of the Rio Carti. There are two other well-defined points of low elevations, one on either side of this low Carti pass. The one at an elevation of 994 feet, made by the headwaters of the Rio Samgandi, a tributary of the Rio Mandinga; the other at an elevation of 1,070 feet, made by a branch of the Rio Carti. The narrow tortuous valleys of these streams offer serious, if not prohibitive, difficulties to any canal scheme.

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*Divide and Chagres Valley reconnaissance.*—This survey, to prove the existence or nonexistence of a low gap between San Blas and Culebra, and incidentally developed portion of the Rio Chagres watershed for hydrological studies, has given what seems to be conclusive data. The divide is everywhere at a height greater than at Culebra or the San Blas gaps.

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#### GENERAL OBSERVATIONS.

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It is curious to note how the animal trails followed the valleys and crest of ridges on the easiest lines of progress. The Indians in former days decided for themselves their lines of transisthmian communication with least work to their physical energies, in so successful a way that they were adopted by the conquering Spaniards. The tendency of primitive people is toward water communication as much as possible. This did not, however, lead the Indians astray on the Isthmus for they gave to the Spaniards the trails across the divide at Carreto, Caledonia, and Sassardi, and these are used to this day.

The routes via the Rio Atrato received no favor from the early Spaniards or their followers, yet on these originated the supposed "mystery of straits," and it can not be doubted that canoes and boats have been passed from the Atlantic to the Pacific. This manner of communication is merely a curiosity without any value for the demands of the present. Balboa's expedition from Caledonia Bay to San Miguel Bay

constituted the first recorded interoceanic survey of a route that has retained its fascination with the present generation of engineers. The Panama route was of a later date, the communication being then with Portobello on the Atlantic coast, for which a paved highway was constructed. With the coming of the Spaniards began the collection of data which at the present time offers much to the engineer student. Our efforts have added to these records extensive detail data regarding the more evident portion of the region of probable canal feasibility—referring to the vicinity of San Blas and of Caledonia.

The divide lies very close to the Atlantic coast all the way from Mandinga to Cape Tiburon and then, rising considerably in elevation, crosses in a southwesterly direction to the Pacific Ocean.

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#### INCIDENTAL.

The Isthmus of Darien extends from near San Blas to the Rio Atrato Valley, lying almost wholly in the province of Panama, Republic of Colombia; a narrow strip along the Gulf of San Blas is part of the province of Colon. In our field of operation on the Atlantic side of the divide the country was much broken up by a complex network of spurs. The watershed is very limited and there are no streams worthy of the name of river. Part of the narrow coastal plain is coralline in structure. A thick forest, abundantly tangled with vines, covers the whole surface of the country and is of such rapid growth that it easily holds in check the feeble efforts of the Indians at cultivation. The soil is, in general, a reddish clay overlying massive rock of volcanic origin, which can be seen exposed in the creeks. These rocks, of an eruptive character, are usually known as "trap," and for our purpose it is not necessary to go into the complex geologic or mineralogic terms. It is very probable that the rock could be easily excavated by machines, but would be of little value for structural purpose on account of its tendency to disintegrate on exposure to the air. Syenite, granite, and sandstone were found in small quantities, but it is possible that exploration might develop beds of these. Many crystals and traces of iron and copper are found in the creek beds,

but nowhere did we observe any evidence of gold, and the Indians did not seem to have any native precious metals in their possession.

Along the coast from Caledonia Bay to San Blas Point there is nearly a continuous string of islands and reefs, which protect the shore of the mainland from the effects of severe storms and afford many safe anchorages. The islands are coralline in structure, and are covered thickly with cocoanut palms which yield superior cocoanuts. Along the coast from San Blas to Cape Tiburon there is a current of about 2 knots per hour. At Cape Tiburon this usually meets the waters of the Rio Atrato, if in flood, and is deflected across the Gulf of Darien and along the coast toward Cartagena. This coast-wise current proved very annoying in our trips with sailing vessels when opposed to its force, especially in the rainy season after the northerly trade winds have ceased, and there are calms of considerable duration. At such times our sloop and schooner would helplessly drift with the current. During the suspension of the trade winds there are fitful shore and sea breezes, usually at night, that would help us in sailing.

The winds of the rainy season come intermittently as squalls, which are dangerous to sail vessels in their fierce outbursts, unless quick and sufficient preparations are made for their coming.

There seems to be no evidence of recent volcanic action or records of earthquakes.

*Climate.*—There are two seasons on the Isthmus, a wet and a dry. Their duration is not well defined, but usually the former lasts from May until January. During this time there is a suspension of the northerly trade winds and showers are very frequent, the rainfall probably approximating slightly more than half that at Greytown, Nicaragua. During the "dry" months there are usually light rains in the mountains each night. The temperature is very even, usually not varying more than 15° during the year between the limits of 75° and 90° F. In the forest this temperature is delightful, and on the high hills the evenings are cold enough for blankets. The climate did not seem to have any deleterious effect by itself, and with proper sanitary discipline it would probably not be disadvantageous for construction work.

*Inhabitants.*—The Indians of the Atlantic side of the Isthmus of Darien make their homes on the coast, or preferably the islands, and cultivate, in haphazard way, small patches of land on the coastal plain or river valleys, gather cocoanuts, and fish. Their features are of Indian type, but physically they are inferior to most Indian races. They are apparently losing in numbers, due to mortality among the children. This is not suprising after seeing the insanitary conditions of the villages. The men are very proficient in sailing or handling the dugout canoes that they fashion with much skill. In these they live most of the day, fishing, getting cocoanuts, or trading. Small trading vessels frequent the coast and exchange cloth and simple articles for cocoanuts and tortoise shell. The men seem to prefer the blue cotton cloth, but the women array themselves in gay yellow and red. The former wear large rings of a copper alloy in their ears, and the latter, in addition to these, have them in their noses, usually elongating the cartilage. There does not seem to be any definite tribal government, but each village has its chief, councilors, and a policeman who carries a carved staff of office. Coronel Inanaguina, with whom our treaties were made as head chief, is a creation of Colombian influences, and the Indians, except near Sassardi, his home, did not seem to know or respect him. The whole Atlantic side of the Isthmus is uninhabited except these few people who live in their palm-thatched villages along the beach or on the islands.

There are Indians on the Rio Morti and Rio Sucubdi who come across the divide to the coast to trade. The coast Indians seem to stand in great awe of these people and explained their unfriendly attitude toward us by their dread of punishment by the mountain Indians if they welcomed us. The coast Indians are peaceable and never committed any overt act during our stay, but their fears, which were those of childish instinct, kept them restless until our departure. Their dread of aggression is rightly inherited from their ancestors, who were ruthlessly sacrificed to the greed of the Conquistadors. While this feeling lingers with the old men, who always govern in the villages, it is apparent that many of the Indians are less conservative. Some speak the English language quite well, on account of visits to

Colon or having shipped as sailors. It is probable that the Indians will long retain their land, as there are no resources to tempt the foreigners. There does not seem to be any intermarriage of these people with other races; any attempt would undoubtedly bring dire punishment. Medical treatment is very primitive and the Indians at times resort to incantations to heal. They appreciate the foreign doctor beyond their medical men, and were not slow to ask for much aid. Apparently any religion they may have had is now very slightly, if at all, observed. The Catholic priests of former days seem to have made no important impressions of their creed. To-day the Indians have many curious carved wooden idols, and not only lack reverence, but at times will barter them. Plantains, fish, and land crabs are the main articles of diet, and these are subjected to very primitive cookery. The Indians practice monogamy in their marital relations and the son-in-law must serve the father-in-law for a certain period or give sufficient goods for his bride.

*Health.*—It is probable our expedition would have as much or more sickness in most parts of the United States. The boils and sores that proved so troublesome were due to dietary indiscretions, poor cooking, and wading in the water. A few light cases of malarial fever yielded very rapidly to simple treatment. The exhausting hill climbing and packing of provisions told heavily on officers and laborers and made the way for the sickness with which we were afflicted. The Indians after they pass childhood seem healthy and live to a considerable old age in spite of their slight attention to sanitary measures.

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*Supplies.*—Where provisions must be packed by laborers it is doubtful if so extensive rations are advisable, and it would be better to limit according to food values and bulk. Rice is the great food of the Tropics, and together with plantains should form the bulk of rations for officers and laborers. The effort to have them use corn meal was a failure; it was too heating for the Tropics. Neither did mackerel appeal to the Colombian laborer's palate. Our cooks—mere water boilers—were to blame for many stomach discomforts, as they had to swim everything in grease. Many of the men suffered inconvenience from a lack of proper personal equipment, and this matter is discussed in Doctor Wickes's report.

His remark in regard to the necessity of a physical examination of men for such expeditions is very pertinent, as persons of physical inferiority certainly are a drag to progress, and then life is not a pleasant one in the severe demands of tropical surveys.

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*Labor.*—The progress of our surveys were greatly limited by the inefficient native Colombian labor, and it has never been my misfortune to meet worse. We were, of course, limited to the men along the coast, and on account of the civil war most of these were hiding from military conscription. These men seemed to have little idea of patriotism, were indolent and capricious. The few men that filtered through from the interior were always noticeable as of superior character. While the wages paid (20 pesos Colombian silver per month) were far in excess of country rates, and they were fed with lavish generosity and even clothed, yet all these they failed to appreciate when they were coupled with work; rather the hand-to-mouth living and the continual siesta, while clothes were not thought a necessity of the Tropics. All laborers had to be advanced money before they would think of going with us, but they were faithful to this obligation.

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We could not prevail on the San Blas Indians to work, but this was not entirely due to aversion to labor, but partly in conformance with their uncompromising attitude of not rendering us any assistance.

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*Camps.*—It was impossible to find thatching for shacks in abundance, as in Nicaragua, forcing us to provide tents, or, rather, large canvas tarpaulins were used. As these were not painted or otherwise treated they deteriorated rapidly from mildew.

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#### TRANSITMAN C. P. HOWARD'S REPORT.

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We reached Cartagena, Colombia, November 16. A revolution was then in progress, and with difficulty a small force of laborers was secured to do the packing and clearing for

the expedition. November 24 we left Cartagena on the *Scorpion*, and reached Caledonia Bay the day following. The Indians who came aboard and hovered around were very much opposed to our landing. In consequence, landing was postponed until several consultations had been held with them, and a treaty finally arranged.

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Most of the work of both parties in December was confined to the country that could be reached from the camp at Caledonia Bay. Early in January, Mr. Ehle having arrived with a considerable force of men, our party moved camp south to the forks of Caledonia River, and about a month later to a site on the east fork, 8 miles by the river from the supply camp at its mouth, and  $2\frac{1}{2}$  miles in a straight line from the nearest point of coast. March 13-14, camp was moved to the supply station at Caledonia Bay, and shortly afterwards to a site on the west fork of river. From these points as a base the Caledonia watershed was explored.

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The higher parts of the ridge were hard to reach on account of the rugged nature of the ravines, and the labor of cutting trails on ridges. It was necessary to camp near the summit, building booths of leaves. The correct ridge at certain points was hard to find, involving much experimental work. Except a few Indian plantations near the coast, the country is all forest. If it should be attempted at any time to trace the divide from Carreto east, it would be wise to make preparations to live on the country by hunting and fishing as much as possible, as, owing to the distance, it would be difficult to reach the coast.

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There was a considerable amount of sickness in the Caledonia camps, but nothing of a serious nature. Boils were very troublesome. When severe, they entirely incapacitated a man from work, especially those on the feet and legs. It was suspected that they might have been caused in part by the use of leggings during the earlier months of survey.

April 11 our party sailed from Caledonia to Carreto Bay, and commenced the survey of the watershed of Carreto River. Our first line followed the river in a southwesterly direction to an elevation of 395 feet, at a point where the river gorge

turns toward the southeast. Here we left the river, and going west crossed the divide at an elevation of 953 feet at a point 500 yards distant from the river. By another line, leaving the river lower down, we crossed the divide in a gap, elevation 815 feet, distant 1 mile to the northwest in an air line from the first gap explored. The last-mentioned gap is very low compared to the ground elevations on the Pacific side, where the stream falls off very slowly. We followed the water courses on the Pacific slope down to an elevation of 750 feet on bank of stream, at a point 4,000 feet from the first gap and 3,000 from the second, and considerably farther by the meanderings of the streams. The streams that flow from the two gaps unite and form one creek at a point a few hundred yards short of the farthest point reached. This low point in the divide corresponds to the gap in the horizon observed from the day before commencing the survey. It is about  $1\frac{1}{2}$  miles southeast in an air line from the farthest point on the ridge reached by reconnaissance of the Caledonia watershed, the barometer elevation of which was 1,625 feet.

The upper part of the Carreto Valley or ravine is rough. The line of survey avoided a half mile of its course by a detour over a hill 650 feet high, the bottom of ravine being impassable at that point.

On completion of the Carreto survey, a stadia line was run to connect with the Caledonia surveys. We followed an Indian trail and the coast line to a point near Point Escoces, supposed to be the site of old Fort St. Andrew; thence across the bay and up a stream to a connection with one of the Caledonia lines. All lines on the Carreto survey were run by stadia measurements and needle bearings, elevations being taken with the level.

The conduct of the Indians at Caledonia Bay was in general indifferent. But during the absence of the *Scorpion* previous to March 14, the occasion on which we moved camp to the shores, much uneasiness was felt concerning their attitude. Our party did not come much in contact with them except by communication with the supply camp at Caledonia Bay. The Carreto Indians were friendly, a fact which was gratifying and of substantial advantage, in view of the supplies of fruit and occasional game which we secured from them.

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**REPORT OF MR. H. H. GRANGER, CHIEF OF PARTY NO. 3.**

The working camp was located a quarter of a mile up the Nercalaqua River, with party No. 4 on the opposite or west side of the river. Here the fresh water was not affected by the tide.

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The scope of the work hoped to be attained by this expedition had as a prime object of a more thorough exploration of the passes at the headwaters of the Carti River than had been accomplished by the earlier surveys.

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The valley of the Carti River was reached in 7 miles by a broken line, following the most favorable ridges to facilitate our progress and to meet the requirements of a simple connecting line. These ridges were composed of rocky spurs reaching a maximum elevation of 420 feet, thinly covered with the residual yellow clay, but affording foothold for the enshrouding tropical forest that is existent from ocean to ocean. For the first mile and a half we covered the low and at times marshy coastal plain. This is the land on which the San Blas Indians make a futile effort to subdue the overwhelming tropical growth for the cultivation of the banana, cane, cocoanut, alligator pears, coffee, etc. At  $3\frac{1}{2}$  miles from the beach we encountered an unmapped river of considerable size that flows directly to the sea. Camp No. 3 was established on the banks of the Carti, at an elevation of 60 feet.

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The Carti River, here averaging 150 feet wide, was well suited to a meander line, though forcing the men to wade continually, but was impracticable for a packing trail. The laborers thus relieved from chopping were put to work clearing a more favorable trail along the crest of the ridges that held the general direction of the river. At points we were thus a mile away, but at intervals were forced in near the river by the larger tributaries, which was taken advantage of for camping ground, to be near the work.

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After the bed of the river attained an elevation of 300 feet, the surrounding range of hills increased in height, towering up from the water's edge narrowing the channel to almost impassable rocky canyons through which the water

rushed with torrential force. This state of the river continued until the very headwaters were reached at the pass located at an elevation of 956 feet, and as measured by our traverse line 20 miles from the zero point on the beach. This summit proved to be the lowest of any subsequently discovered in this region.

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*Climate.*—At our beach camp it was generally hot and stifling, rendered burdensome by the mosquitoes at night, and a minute gnat at all times. Still the men in charge the of commissary camp and the doctor attached to our party became accustomed to these discomforts and remained there the season through without any ill effects from the location. When once an elevation of 100 feet was attained, or even 50 feet, a noticeable improvement was felt, the woods and soil laden with moisture had a decided tendency to modify and temper the rays of the sun. At night a light covering was always desirable and the mosquito nets were always used as a protection against heavy dews. At an elevation of 1,500 feet the atmosphere was invigorating to a marked degree, but usually toward sundown clouds heavily laden with moisture came rolling up from the Atlantic side, enveloping our camp in a dense fog, the dampness penetrating our clothing and bedding much to our discomfort. Our fieldwork, continuing from the middle of January to the latter part of May, was favored by the dry season; however, there was enough rain falling, usually a soaking shower once a week, to start all vegetation and thus keeping the ground saturated and giving rise to running rivulets in all arroyos even at the highest elevations. The continued healthfulness of our party was doubtless in a great measure due to the cool and pure water always at hand.

*The San Blas Indians.*—The small islands along the coast encircling Mandinga Harbor are clustered with the dwellings of a numerous branch of the ancient tribe of the San Blas Indians, which they inhabit to the exclusion of the mainland, thus obtaining full benefit of the cooling trade winds. Here in this isolated position they live a life of independence, with no restraint from the Colombian Government, claiming the mainland by family allotment, submitting to their tribal regulations peacefully, and having duly appointed executives. They are industrious to a marked degree, constantly fishing,

clearing up small patches for cultivation, or gathering the ripening fruits and nuts and disposing of the surplus in Colon in exchange for domestic necessities. They present a picturesque sight while skillfully handling their small canoes in the open Gulf or paddling up the navigable rivers.

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As long as our camps were accessible from navigable streams we were frequently visited by curious groups of Indians, but were never molested by them further than missing a few tins of supplies that were left unprotected, for they were generally attending to their own affairs. These Indians will likely be permitted to retain possession of these islands for all time, for the interior is doomed to remain a wilderness.

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#### REPORT OF MR. W. P. ALFORD, CHIEF OF PARTY NO. 4.

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General report relative to the exploration of the Isthmus from the Mandinga Pass to the source of the Rio Chagres and down the river to Gorgona, on the Panama Railroad.

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The object of this exploration was to \* \* \* determine the existence of a pass in the Cordillera lower than 1,000 feet, if such a pass existed; also, to learn the general character of the topography, flora, and geology of this section, which has heretofore been an unknown wilderness.

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While the laborers were packing provisions from the commissary I was personally occupied in exploring the valley to the south and on the Pacific side. This valley is a part of the drainage of the Rio Chepo, and the river is as large as the Carti. It heads due west in the high mountains, and as it does not appear on the map I assumed that heretofore it was unknown except to the Indians, and named it "Rio Gaston." The Butler River, shown on the Selfridge map, flows into this river to the south and east of the Mandinga Pass. I also followed the divide to the west for a distance of a mile and a half, and located our second camp close to a fine spring.

On Saturday, May 5, five weeks' provisions were at camp No. 1, and early that morning we broke camp and made our real start along the divide for the Chagres River.

The work was distributed among the officers and men, as follows: Myself and one native did the advance scouting, blazing the trail along the divide and determining as far as possible the most feasible path for a packing trail. Owing to the peculiar conformation of the divide along this part of the Isthmus, this work proved slow and exceedingly arduous. To find the divide and trace it, we were compelled many times to climb down from the summit of the high ridges to deep gorges, often 500 or a thousand feet deep, then slowly and with infinite labor follow up the stream to its source. This operation would be sometimes repeated on the opposite side, thus making doubly sure of our position; then cutting back along the divide to our trail, we were able to carry the advance scouting along the backbone of the Cordillera.

Owing to the almost impenetrable jungle vegetation, our progress was often slow, yet in the face of all the trying and fatiguing labor of tracing the continental divide, our progress averaged about 1 mile per day up to the time we reached the headwaters of the Chagres, on May 18.

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At every step of our progress along the divide unusual difficulties met us. The crest of the Cordillera from San Blas to the Chagres was covered with a mass of wet, slimy, creeping vines, binding the dense underbrush into a solid mass of undergrowth. The divide itself is an almost inexplicable factor in its erratic windings. The series of nearly parallel ridges running with the axis of the Isthmus form only so many links in the chain. These high ridges are connected by two traverse ridges, usually so low and obscure that their presence, even when the view is unobstructed, is uncertain, and at a season of the year when it rains almost every hour of the day it is impossible to know where or when to look for them. The advance work of cutting a path along the crest of the divide, and being able to follow it from ridge to ridge, is a most serious problem, and even when conditions are favorable, which seldom occurs, the work is most difficult.

The topography of this part of the Isthmus consists of three main ridges running approximately east and west with the Isthmus. There is a high mountain range lying between the Pacific and the Rio Gaston that swings to the north

near the head of the Rio Chagres and forms the Cordillera proper; also another range of mountains that runs out on San Blas Point and joins the main range near the same place as the range on the south. Between these three ranges there are innumerable spurs and low ridges, separated by deep gorges and narrow valleys. At the point where the mountain range on the south and from San Blas Point joins the Cordillera occurs the highest mass of mountains. This, as shown by the profile, reaches an elevation of nearly 3,000 feet. From the Mandinga Pass, at an elevation of 994 feet, the gradient is uniformly ascending to the summit of the mountain, and is indicated on the map as "Brewster Peak."

The flora of the divide is almost identical with that found at San Blas and other parts of the Isthmus, excepting possibly a less marked tropical vegetation. This can be accounted for by the higher altitude, and it impressed us as being more subtropical. There are few valuable woods aside from an occasional mahogany or cedar. The palm family is poorly represented. Only one species attracted our attention, and unfortunately only the local Indian name was secured, viz, "Palma amarga." This palm is peculiar in its giant leaves, which are circular and fully 4 to 6 feet across the solid central part, and from this solid part radiate long pendants, making the leaf fully 8 or 10 feet in diameter. The trunk is covered with a hairy fiber, which makes it appear much larger than it really is. This tree is only found in one small locality and at an elevation of about 2,500 feet. The geological formation is difficult to describe, owing to the fact that all rock exposed to the action of the atmosphere is rotten. A few general observations were made as opportunity offered. The rock formation is granite and composed of two principal varieties, namely, a dark blue and a variegated gray granite. Often these two kinds of stone would be found cemented together, with the line of demarcation cut sharp, while the mass itself was one. The most prominent feature noticed relative to the general character of the rock was its dip. This wherever its stratification was observable was found to dip toward the south or Pacific side at an angle of 10 to 15°. This observation was borne out by the fact that all springs on the Atlantic side are from 300 to 1,000 feet below the crest of the divide, while on the Pacific side water can often be found at the head of the water courses and within a few feet

of the summit of the backbone. Only in two instances did we find traces of volcanic action, and these were on spurs of the divide and might have been caused by a buckling, due to a sudden lift and cooling and then dropping to the normal level. It is safe to say that very little evidence of volcanic action is to be found between San Blas and Panama.

On reaching the summit of Brewster Peak, May 18, it was quite evident that at last we were in the watershed of the Chagres River. At this point the continental divide swings to the southwest for a distance of 2 or 3 miles, where it meets and joins a high mountain range, running parallel to the Pacific coast. From the top of Brewster Peak we had a fine view down a valley running nearly S. 60 W. As this was almost the first clear day since leaving the Mandinga Pass, it seemed quite providential that such an opportunity was offered to verify our position by surrounding conditions. Up to this time we had kept a rough traverse, that our location might be approximately known, and our position on the map so nearly coincided with our surroundings that we felt confident in our position. Other observations from this mountain developed the fact that the Mandinga River heads on the northeast side and the Rio Gaston on the south side, while the Rio Chagres finds its head near the summit on the southwest face.

Leading off from the mountain there is a long spur fully three-quarters of a mile in length, which leads down to the river on the north side. As the spur runs in the direction of the valley, we followed it down the river. Previously I had explored the stream and found it to be so hemmed in by perpendicular rocks that it was impossible to follow down the bed of the stream. Like all other water courses in this section the amount of water collected in a given area is surprisingly large, and when we reached the river scarcely 1 mile from its head, we found fully 10 cubic feet of water flowing per second and increasing rapidly as we went down the river. About one-half mile below this point, which is indicated on the map as Camp No. 6, the river narrows up, and for three-quarters of a mile there is a deep gorge, necessitating the cutting of a trail up an almost perpendicular bluff and down on the other side of the bluff to the river. Although the difficulties we had met on the divide had been many, yet their aggregate was less fatiguing than the work

of cutting a trail up these bluffs and around the gorges, which became so many and so difficult of passage that we were at one time tempted to leave the river for the hills, but this was abandoned after one trial, as it carried us a long way from the river. On coming back to the river we found another gorge just below which proved more serious to pass than any of the previous ones, as it was nearly 5 miles long. Repeatedly we had to cut a path up an almost perpendicular bluff, down over detached bowlders and through a labyrinth of vines, and as at this time we were, both officers and men, packing from 30 to 50 pounds on our backs, the labor can well be imagined. In this gorge the channel varies from 20 to 50 feet in width, and the depth of the water is from 10 to 30 feet. The appearance of these gorges indicates that the river is following a fissure, caused by an earthquake, which opened a huge crevice parallel with and along the north side of the divide. Up to this last gorge, named Danta Canyon, there were three considerable streams entering the Chagres—two from the north and one from the south. The most noticeable feature of these streams was the marked difference in the color of the water, as well as the marked change in the temperature. The streams from the south were all as clear as crystal and the water cold, evidently coming from high altitudes and running over a rocky bed. The streams entering from the north were all greatly discolored, having the appearance of swamp water, and the temperature was several degrees warmer. Why this difference should exist I am unable to state, as our observation from the top of the hills failed to locate any area sufficiently level to admit a swamp. The discoloration may be due to an alluvial soil through which the rivers flow. This can easily be, as there evidently is a section lying between the mountains forming the divide and the range that runs close to Portobello, where the rock is less pronounced, and consequently there is a greater amount of soil over the rock, through which the water finds its course.

From the source of the Chagres down several miles the river drops at the rate of 200 feet per mile, and then there is a uniform drop of 25 feet to the mile until we reach Santa Barbara, the upper gaging station. This rate of descent in the river makes a series of rapids. While not continuous, they are so close together that only a few hundred feet sepa-

rate them. The channel where the rapids are most numerous is filled with bowlders from the size of a man's head to the size of an omnibus. As the water rushes over and between the rocks it is churned into a white foam. The perpendicular rocks often compelled us to cross these rapids to gain a better footing on the other side. As some of the men were unable to swim, a sense of relief was always felt when all were safely across. Often long poles would have to be held out in the channel to give support to the weaker men, as the swift current would catch them in midstream. On several occasions the men and packs were completely submerged and had to be pulled ashore by the men holding the poles on the bank. Although these incidents were often dangerous, yet they furnished much merriment, which greatly relieved the monotony of the laborious work of packing and travel. This work was continued from May 18 until May 26, when the difficulties became so great that we determined to build rafts and, if possible, make greater speed even at greater personal risk.

On Saturday afternoon, May 26, after working our way over a high bluff and through an almost impassable canyon, we stopped and began the work of raft building. This proved less difficult than at first expected. Along the banks there were plenty of trees, known to the natives as "balsa," which make an ideal raft owing to its wonderful cork-like nature. The rafts were about 8 feet long and 5 feet wide, bound together by crosspieces securely pinned to the logs. Although these rafts were comparatively small, yet they would carry safely 500 pounds.

On Saturday morning, May 27, the finishing touches were given to the five rafts, and at 9 o'clock our baggage and provisions were securely lashed to the rafts, and the personnel of the crews determined by distributing the poor men among the experienced men. On the two rafts in the lead, and this position was maintained during the entire trip, were Mr. Philips, Mr. Coates, and myself, with two trusty natives. The two days on the rafts furnished many exciting incidents as we whirled in and out among the rocks or slowly poled our way through the still water. Often in shooting the rapids we would strike great bowlders in midstream, or at a sharp angle in the channel we would be thrown on the rocks, often with such force that we were unable to keep our footing and so would be thrown into the river; yet with all the many

upsets and duckings that we were subjected to we reached Santa Barbara safely and without any serious accidents. In looking back over the trip from the time we left the pass until we reached the gaging station, it seems almost providential that we escaped serious accidents and sickness. Our nights were spent in the jungle or on the sand banks, often without protection from the elements, and the days were passed in the most difficult work of climbing rugged hills and down gorges or in shooting rapids where bowlders were as thick as pebbles. During this trip no signs of Indians were found, and as far as the observations of the party go, there are no Indians between the Gulf of San Blas and Santa Barbara on the Chagres River. There were many stories circulated relative to the Indians on this part of the Isthmus, and we expected to be fed on poisoned arrows and have the nights made hideous by the fear of massacre; but these stories were merely myths, emanating from timid people.

The animal life is exceptionally meager, even the ever-present monkey seems to feel lonely in the solitude of this vast wilderness. An occasional tiger track was the only indication that the animal lived at all in this section. The wild hogs, so plentiful in Nicaragua, are seldom found on this part of the Isthmus. Wild turkey and a large "pava" are found in sections, but not plentiful enough to be depended upon for meat. The "danta," or tapir, are numerous along the upper waters of the Chagres, and as they have never been hunted or disturbed by man, there was little difficulty in shooting them. There are very few snakes to be found in any place along our survey on the Nercalagua or the divide. Why this fact should be, not only relative to the snakes, but to all animal life, seems to be an unanswered question, unless it be the dividing line between North and South America in the animal and vegetable world.

#### REPORT OF DR. G. L. WICKES, SURGEON TO EXPEDITION.

\* \* \* \* \*

##### (1) EFFECT OF CLIMATE.

During the dry season there were occasional heavy downfalls of rain occurring through the day, as a rule. After May 1 the bulk of the rain fell between sunset and sunrise.

The wetting from rain had little effect on the men's health, as they were continually wet from day to day from wading the mountain streams. Prolonged exertion when chilled by water-soaked garments predisposed one to slight febrile attacks and bilious fever. The danger of this was greatly lessened by a bath followed by a brisk rub down on the return to camp. The greater part of the work of the survey was done at an elevation of over three hundred feet, so the men were not exposed to the worst form of the tropical climate. The absence of swamps and mosquitoes at this elevation precluded the infection of malarial fever, while the dense growth of trees, vines, and underbrush was a complete protection from the sun. It can not be said that the men suffered much from the climate. Enervation and bilious fever were about all that could be charged up against it. The first was a natural and expected result, and the latter was due more to the lack of physical condition of some of the men than to the effect of the climate. None of the officers was subjected to a physical examination before starting for the Isthmus, and naturally many of them were ill-conditioned. Men who are at all inclined to stoutness do not stand hard work well in this climate. There was no case of isolation in any of the parties.

## (2) SICKNESS.

(a) *Swamp sores*.—The affection locally known as "swamp sore" differs but little from the indolent ulcer in description, progress, course, and treatment. This, though a minor ailment, was the most annoying and frequent ailment with which the writer had to contend. The development of swamp sores depended on several conditions, as follows: In certain localities along the seacoast or in swampy districts biting insects became very numerous and troublesome. The itching occasioned by gnats, sandflies, and mosquitoes was at first slight and easily bearable. This irritation gradually increased in severity and became so unbearable that to refrain from scratching the points of the itching skin was eventually an impossibility. Many of the officers were unable to sleep until they had at first scratched the epidermis from the bitten area. Others would seek the same relief from the intolerable itching in their sleep. This resulted in numerous raw, inflamed surfaces which were prevented from healing through

the constant wading necessitated by the work of the survey. It was noticed that those wearing canvas leggings suffered most from swamp sores. Infection naturally followed the delayed healing of the primary abrasion. The ulcers were mostly confined to the lower limbs, though a few developed on the arms. They were not observed on any other part of the body. In appearance these sores resemble any small superficial ulcer. They are red, inflamed, irregular-shaped depressions, some round, others oval, and varying in size from that of a dime to a 25-cent piece. While actively inflamed the border and base is irregular and angry looking, but during the subsequent process of cicatrization they present a smooth punched-out appearance. The secretion is a characteristic, clear sero-purulent fluid which may be slightly sanguineous at times. This secretion is constantly collecting beneath a crust of false cicatrization which alternately breaks, discharges, and re-forms during the active stage of the sore. These sores may be single or multiple. As many as a dozen have been observed on one limb. They affect the skin and subcutaneous tissue, but go no deeper, their further growth following a lateral direction by continuity of tissue. A cure results in a pigmented scar bluish red or reddish brown which remains for several years. The treatment is the same as that for any infected surface, but difficult when the patient continues working. Rest and antiseptic dressings, daily, result in a cure from two weeks to a month, depending on the amount of tissue destroyed. When the patient continues working the rule should be antiseptic dressings twice daily, and the application of an impervious dressing of cotton and flexible collodion every morning. Prophylactic measures embrace the avoidance of being bitten by insects as far as possible and treatment to allay the irritation of the stings when they have occurred. When wading streams continually the clothing about the lower limbs should be as light as possible and canvas leggings should not be worn. The development of swamp sores also depends on the condition of the patient's blood. They were much worse in anæmic individuals and consequently worse for everyone during the process of acclimation. They were very general among the officers; hardly a man escaped them. The native Colombians were not subject to them.

(b) *Boils*.—Many men were temporarily incapacitated from duty from this cause.

(c) *Bilious fever*.—This was the most frequent serious illness encountered. The symptoms were headache, dizziness, loss of appetite, nausea, vomiting, constipation, and a constant temperature of 104° F.

(d) Contrary to expectations, very few cases of intermittent fever were developed among the officers. But two cases occurred in this party (No. 2), both of the tertian type and both yielding readily to the orthodox treatment of rest in bed and quinine sulphate administered twice daily.

(e) *Gusanos* caused universal annoyance to all of the officers. They resembled boils very much, from which they were differentiated as follows: The gusano is caused by the larvæ of some insect—probably the gadfly—hatching in the skin and forming a grub there. When squeezed the thin yellowish fluid always escapes from the apex of the tumor through a small aperture, which is constantly present. This is characteristic of the gusano. The grub is best expressed by squeezing, after the application of an impervious dressing.

(f) There was one case of acute lobar pneumonia, which after running a typical course came down by lysis. The patient was a native Colombian.

(g) *Infectious diseases*.—There was no yellow fever or smallpox in the vicinity of the various camps, and the Indians have no recollection of an epidemic of the former. At Carreto the Indian village was half depopulated by variola about ten years ago, and fully 50 per cent of the present inhabitants of this town bear the characteristic pitting on their faces to the present time.

The native Indians are subject to enteritis, dysentery, and measles, but none of the Americans or Colombians in party No. 2 were affected by these diseases.

### (3) LOCATION AND SANITATION OF CAMPS—WATER SUPPLY.

Whenever possible the chosen camp site was located on the banks of a clear running stream. The best sites were on a slight grade, as better drainage was secured and drier camps resulted. Latrines were made by digging pits and covering fresh excreta with loose sand or dirt. These were situated from 50 to 100 feet from the camp proper. All other refuse was disposed of in a similar manner. The pits were located, of course, at a lower elevation than either the camp or the water supply.

The tent flies in conjunction with the rubber sheets suspended above each cot afforded ample protection from the heavy rains at night. Neither would have sufficed alone. The flies mildewed and became very leaky after two months' service in the brush woods. The water supply came from the small mountain streams and was invariably pure. Either boiling or filtering it were unnecessary precautions. To this purity of the water is ascribed the perfect freedom from enteritis and dysentery enjoyed by the men. Not a case of either sickness occurred after leaving Cartagena in this camp.

#### (4) DIET AND COMMISSARY.

Of the articles of food included in the commissary it can be said that most of them were healthful, palatable, and climate proof. There were a few exceptions, however, here noted. The allowance of corn meal per capita was too large; less than one-fourth of it was eaten. Canned tomatoes did not withstand the climate, and all were spoiled. The same was true of all the ham prepared in cottolene. The Imperial brand of cheese was the only variety that did not spoil. The men did not care for the salt mackerel, though it kept well; but bacon was eaten daily with relish to the end of the expedition. The men were generally affected by a slight distaste for food after several months' work on the Isthmus. Dilute whisky, sherry wine, or claret seem almost a necessity in small quantities. Heavy drinkers do not last long in the Tropics.

#### (5) PERSONAL OUTFIT.

For a six months' expedition:

Pocket case of toilet articles.	Large pocket knife.
Three towels.	One poncho.
One housewife.	Two rubber blankets.
Straw hat.	One rubber bag.
Felt hat.	One pair heavy leather slippers.
Two woolen overshirts.	One air pillow.
Two or three suits woolen under- wear.	One pair rubber overshoes.
Six pairs woolen hose.	One woolen blanket.
Two pairs duck hunting pants.	Mosquito net.
Soap box.	Canvas hat.
Fountain pen.	Three pairs heavy hunting shoes.
Stationery.	Handkerchiefs.
	Two suits woolen pajamas.

Few went to the Isthmus properly supplied with shoes. The best wading shoes did not last longer than two months, some but six weeks. Constant wading, cutting from rocks, and dampness resulting in mold were responsible for this.

(6) SURGEONS' OUTFIT.

The surgeons accompanying a party to the isthmus should be allowed a voice in the selection of the medicines and instruments. The following list comprises only articles that are indispensable:

One field case, with a capacity of three dozen bottles, and with ample room for the articles necessary, such as bandages, dressings, ointments, instruments, etc. The complete case should not exceed 30 pounds in weight. There should be an ample supply of calomel tablets, gr.  $\frac{1}{16}$ , and gr.  $\frac{1}{4}$  solu. ipecac; quinine sulphate tablets; flexible collodion and camel's hair brushes; one pocket case of instruments; one hypodermic syringe and outfit; three fever thermometers.

A sufficiently varied supply of medicines and surgical appliances to meet the occurrence of diseases of the Tropics and possible accidents.

As far as possible all medicines should be in tablet form and in well-stopped bottles. All gelatin capsules spoil rapidly.

The instruments need constant care and oiling to protect them from rust, which forms very rapidly.

In the description of the diseases in this report encountered on the isthmus I have given the greatest prominence to those that gave us the greatest troubles without regard to the seriousness of the malady.

No serious accidents occurred in party No. 2. No diseases more serious than malaria and bilious fever was developed among the officers of the expedition. There was an entire absence of diarrheal dysenteries owing to the sanitary precautions and splendid water supply.

Native fruit in small quantities did not disagree with the men.



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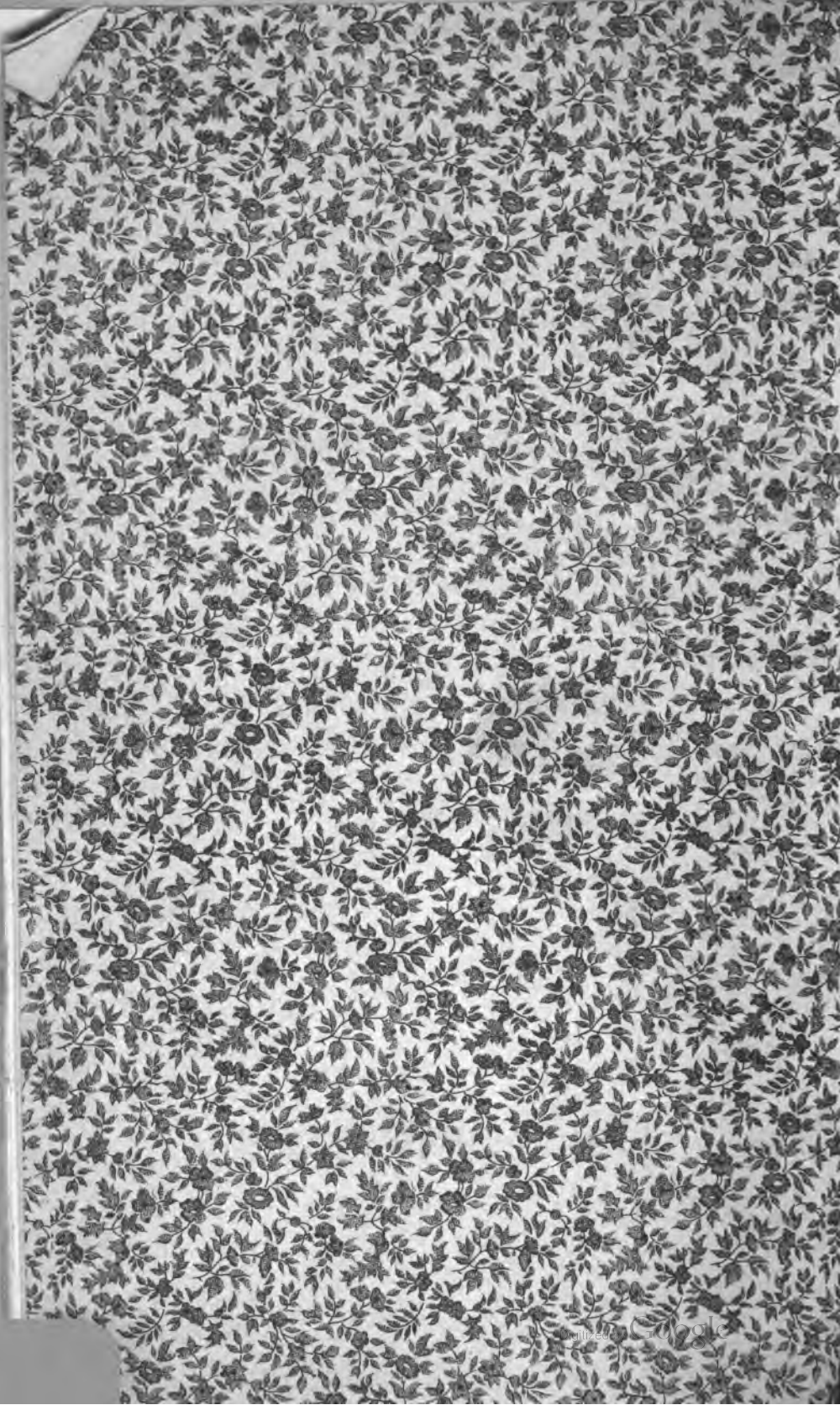
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